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A best-evidence review of diagnostic procedures for neck and low-back pain

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This chapter aims to present an overview of the best available evidence on diagnostic procedures for neck and low-back pain. Relatively little is known about the accuracy of such procedures. Although most spinal conditions are benign and self-limiting, the real challenge to the clinician is to distinguish serious spinal pathology or nerve-root pain from non-specific neck and low-back pain. The use of valid procedures can assist the clinician in this aim. A search was conducted in PubMed to identify relevant systematic reviews and primary studies on diagnostic procedures for the neck and low back. A systematic review was included if at least two independent reviewers were used; a systematic procedure was followed for identifying the literature; and a methodological assessment was conducted. In the absence of systematic reviews, primary studies are reported. Systematic reviews were identified which evaluated evidence for diagnostic procedures in the following categories: history, physical examination, and special studies, including diagnostic imaging, diagnostic blocks, and facet and sacroiliac joint injections. In general, there is much more evidence on diagnostic procedures for the low back than there is for the neck. With regard to the history, a number of factors can be identified which can assist the clinician in identifying sciatica due to disc herniation or serious pathology. With regard to the physical examination, the straight-leg raise is the only sign consistently reported to be sensitive for sciatica due to disc herniation, but is limited by its low specificity. The diagnostic accuracy of other neurological signs and tests is unclear. Orthopaedic tests of the neck, such as Spurling's or the upper-limb tension test, are useful to rule a radiculopathy in or rule out, respectively. In patients 50 years of age or older, plain spinal radiography together with standard laboratory tests

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are highly accurate in identifying underlying systemic disease; however, plain spinal radiography is not a valuable tool for non-specific neck or low-back pain. There is strong evidence for the diagnostic accuracy of facet joint blocks in evaluating spinal pain, and moderate evidence for transforaminal epidural injections, as well as sacroiliac joint injections for diagnostic purposes. In conclusion, during the history, the clinician can accurately identify sciatica due to disc herniation, as well as serious pathology. There is sufficient evidence regarding the accuracy of specific tests for identifying sciatica or radiculopathy (such as the straight-leg raise) or certain orthopaedic tests of the neck. Plain spinal radiography in combination with standard laboratory tests is useful for identifying pathology, but is not advisable for non-specific neck or low-back pain.

Key words: neck pain; low-back pain; diagnosis; diagnostic procedures; review; red flags; yellow flags; psychosocial.

Neck and low-back pain are common and costly problems in Western society. In order to treat these conditions effectively, it is imperative to establish a correct diagnosis at the initial presentation. This initial diagnosis can pose some important challenges, however, because the clinician cannot distinguish with infallible accuracy between those patients with benign conditions and those with radicular pain or serious spinal pathology.

In the initial stage, the primary function of the history and examination is to distinguish those patients with pain of musculoskeletal origin from those with non-spinal or serious spinal pathology. Once this is accomplished, the next priority is to rule out those patients with nerve-root pain. The patient's pain and pattern of distribution will most probably suggest whether this is the case or not. All other cases should be classified as 'non-specific'. Although this seems quite fundamental, this diagnostic triage serves another function. By conducting a thorough history and physical examination, it is possible to evaluate the degree of pain and the functional disability of the patient. This serves to guide the clinician in a management strategy.

The purpose of this narrative review is to present the best evidence on the principal tools available to the clinician for establishing a correct working diagnosis, including the history, physical examination, and special studies consisting of diagnostic imaging, diagnostic blocks, facet joint or sacroiliac injections, and laboratory testing. By identifying accurate and useful diagnostic procedures for neck and low-back pain, the primary-care physician can make an informed decision regarding the management of these conditions. Where available, we present the results of systematic reviews, and where relevant we present the results of primary studies.

METHODS

Procedure

We searched the PubMed version of MEDLINE from 1997 for systematic reviews and relevant primary studies on diagnostic procedures for neck and low-back pain. Studies were identified by use of MESH terms or the following free text words: neck pain, low-back pain, diagnosis, radiculopathy, spinal diseases, and systematic review. In some cases, these search terms were also truncated in order to broaden the search. We excluded studies on whiplash, animal studies, and effectiveness studies of therapy. We did not place limits on the search regarding language. Details of the search are available from the corresponding author upon request. In addition, the references of all articles were scanned for relevant articles not identified during the search.

We used the COST B13 project on European Guidelines for the Management of Acute and Chronic Low Back Pain in Europe as basis for the current review.[1,2]

Inclusion criteria

A systematic review was included if: (1) at least two independent reviewers were used; (2) a systematic procedure was followed for identifying the literature; (3) methodological quality was assessed using defined criteria; and (4) the data were analysed. A primary study was included if it examined diagnostic accuracy for any of the subheadings examined in this article, and was not included in a systematic review.

RESULTS

Evidence has been subdivided into the following categories: history, physical examination, and special studies, consisting of diagnostic imaging, diagnostic blocks, facet joint and sacroiliac injections.

History

Problem definition

A simple and practical classification system for neck and low-back pain can be divided into three categories: specific spinal pathology, nerve-root pain/radicular pain, and non-specific neck or low-back pain. The first level of diagnostic triage during the history-taking is to identify 'red flags' and assess potential 'yellow flags'.[3] Red flags are signs or symptoms that should raise the suspicion of serious spinal pathology, whereas yellow flags are factors that increase the risk of developing or perpetuating chronic pain and long-term disability (see Tables 1 and 2).[3] Clinical suspicion can be confirmed later by further investigation; however, at this point the primary goal is screening. The subsequent step is to identify those subjects with nerve-root pain. The patient's pain distribution and pattern should raise clinical suspicion, which when confirmed by the clinical examination should be a reason to refer for further evaluation.

Table 1. Signs and symptoms with a high probability of being associated with specific causes of low-back pain.

Red flags			
Age	History	Symptoms	Findings
Presentation under 20 years	Violent trauma	Constant, progressive, non-mechanical pain	Persisting severe restriction of lumbar flexion
Onset over 55 years	Past history of cancer	Neurological symptoms	Neurological signs
	Systemic steroid use	Systemically unwell	Structural deformity
	Drug abuse	Weight loss	
	HIV	Thoracic pain	

Signs and symptoms compiled (with slightly modified categories) from Hutchinson et al (1999, *Clinical Guidelines for the Management of Acute Low Back Pain*. London, UK, Royal College of General Practitioners) with permission.

Table 2. Risk factors for occurrence and chronicity of non-specific low-back pain.

Yellow flags		
	Occurrence	Chronicity
Individual factors	Age	Obesity
	Physical fitness	Low education level
	Strength of back and abdominal muscles	High levels of pain and disability
	Smoking	
Psychosocial factors	Stress	Distress
	Anxiety	Depressive mood
	Mood/emotions	Somatization
	Cognitive functioning	
	Pain behaviour	
Occupational factors	Manual handling of materials	Job dissatisfaction
	Bending and twisting	Unavailability of light duty on return to work
	Whole-body vibration	Job requirement of lifting for 3/4 of the day
	Job dissatisfaction	
	Monotonous tasks	
	Work relations/social support	
	Control	

From van Tulder et al (2002, *Best Practice and Research Clinical Rheumatology* 16: 761–775) with permission.

Scientific evidence: low-back

The recent systematic review by Vroomen et al of 37 studies of subjects suspected of sciatica due to disc herniation found pain distribution to be the only useful history item.[4] One primary study found low agreement ($\kappa = 0.40$) between examiners regarding the history for patients with suspected lumbar nerve-root involvement. This increased moderately ($\kappa = 0.66$) following the physical examination.[5] It was recommended that, for a consistent overall diagnosis, emphasis should be placed on the response to pain with coughing, sneezing, and straining, a feeling of coldness in the legs, and urinary incontinence.

A recent systematic review by Henschke et al evaluated the diagnostic accuracy of clinical features and tests used to screen malignancy in patients with low-back pain.[6] Six studies were identified which evaluated 22 different clinical features and tests. A combination of age $\geq$50 years, a previous history of cancer, unexplained weight loss, and a failure to improve after 1 month of presentation had a reported sensitivity of 100%. The most useful features and tests to be identified were a previous history of cancer, elevated erythrocyte sedimentation rate (ESR), reduced haematocrit, and overall clinician judgement, which increased the probability of identifying malignancy when present. Overall, however, the methodological quality was poor, and few studies were performed in the primary-health-care setting, which is the setting in which diagnostic accuracy should be assessed with regard to screening of low-back-pain subjects.

An older systematic review of 36 studies evaluated the accuracy of the history, physical examination, and ESR in diagnosing low-back pain.[7] The review specifically examined the accuracy of signs and symptoms in diagnosing radiculopathy, ankylosing

spondylitis, and serious spinal pathology. For radiculopathy, no single test had a high sensitivity or specificity. Night pain and reduced lateral mobility seemed to be only moderately associated with ankylosing spondylitis. However, when the history was combined with ESR, this seemed to have a high diagnostic accuracy for serious spinal pathology.

One systematic review on pain drawings was identified for the purpose of being able to assess the psychological state of patients.[8] Nineteen articles were included and evaluated, of which most focused on low-back pain. Only three studies concluded that the association between pain drawings and psychological state was sufficiently strong for clinical use. The authors concluded that there are insufficient data to support the hypothesis that unusual pain drawings or extensive marking can be used to identify a disturbed psychological state.

Scientific evidence: neck

No systematic reviews were identified which examined the diagnostic accuracy of history-taking in patients with neck pain.

Comments

Individual red flags do not necessarily mean the presence of serious pathology; however, the presence of multiple red flags should raise clinical suspicion and indicates the need for further investigation. Red flags have not been evaluated comprehensively in any systematic review; however, the incidence of spinal tumours is very low. In the academic and private practice setting, this reached 0.7% and 0.1%, respectively, of the population examined[9], suggesting that the chance of missing serious pathology, especially in the private practice setting, is exceptionally low. Nachemson also claims that in the absence of red flags, and despite a careful clinical assessment, serious spinal pathology was detected by radiographs in just one in 2500 patients.[10] It should be stressed that radiographs do not and should not compensate for an inadequate assessment as a result of, for example, time constraints.

Physical examination

Problem definition

The physical examination seeks to confirm or potentially rule out an underlying serious pathological condition or any condition resulting in neurological compromise. The basic elements of the physical examination include inspection, palpation, observation (including an examination of range of motion), and a neuromuscular evaluation. The neurological portion of the exam should evaluate the deep-tendon reflexes, motor strength, and distribution of any sensory complaints.

Scientific evidence: low-back

Straight-leg-raising test. In 1999 Vroomen et al conducted a systematic review of the diagnostic value of physical examination for the diagnosis of sciatica due to disc herniation.[4] The straight-leg-raising (SLR) test was the only sign that was consistently reported to be sensitive for sciatica due to disc herniation (pooled sensitivity 0.85;

95%CI 0.38–0.98), but the specificity was low (0.52; 95%CI 0.26–0.76). Diagnostic accuracy of other neurological signs (paresis, sensory loss, reflex loss) was unclear.

Another systematic review of 11 studies that were surgical case-series at non-primary-care level evaluated the diagnostic accuracy of the SLR.[11] The authors concluded that diagnostic accuracy of the SLR test is limited by its low specificity. Meta-analysis showed that the pooled diagnostic odds ratio for straight-leg raising was 3.74 (95%CI 1.2–11.4). The pooled sensitivity for SLR was 0.91 (95%CI 0.82–0.94), while pooled specificity was only 0.26 (95%CI 0.16–0.38). The pooled diagnostic odds ratio for the crossed-straight-leg-raising test was 4.39 (95%CI 0.74–25.9), with low sensitivity (0.29; 0.23–0.34) and high specificity (0.88; 0.86–0.90). Both reviews identified methodological flaws in the original studies that hampered a valid evaluation.

A systematic review by Rebain et al (2002) evaluated the SLR procedure and its implications for clinical practice.[12] The authors concluded that there is no standard procedure for passive SLR and that there is no consensus on interpretation of the results of passive SLR. Intra- and inter-observer reliability were considered good in most studies and better in a hospital setting than in primary care. A recent study in primary care also demonstrated good inter-observer reliability ($\kappa = 0.70$).[13]

One primary study found good agreement for decreased muscle strength and sensory loss ($\kappa = 0.57$–0.82), intermediate agreement for reflex changes (0.42–0.53), and poor agreement in the examination of the lumbar spine (0.16–0.33).[5] The straight-leg raise, crossed-straight-leg raise, Bragard's sign, and Naffzigger's sign were the most consistent nerve-root tension signs ($\kappa = 0.66$).

Spinal palpation. Hestbaek et al, 2000, evaluated reliability and validity of chiropractic tests to determine the need for spinal manipulative therapy of the lumbopelvic area. Only tests for palpation of pain had acceptable results. Motion palpation tests were not reliable. Palpation for muscle tension, palpation for misalignment, and visual inspection were undocumented, unreliable, or not valid.

Another systematic review found that reliability of most commonly used examination procedures by clinicians in patients with low-back pain was low.[14] Identifying the spinal level, passive accessory movements, establishing a comparable level, passive physiological movements, evaluation of muscle tension or spasm, and determining the existence of a fixation or manipulative lesion, and instability tests all showed low reliability or conflicting results.

A systematic review of 48 studies considered the intra- and inter-observer reliability of motion palpation, static palpation, palpation of osseous structures, soft tissue palpation (pain and changes), and global assessment (combination of at least two tests).[15] The pooled inter-observer reliability was acceptable for palpation of osseous structures ($\kappa = 0.53$) and soft-tissue pain ($\kappa = 0.42$), but low for motion palpation ($\kappa = 0.17$) and soft-tissue changes ($\kappa = 0.03$). Intra-observer reliability was also good for palpation of osseous structures ($\kappa = 0.91$) and soft tissue pain ($\kappa = 0.65$), but not for other tests.

Seffinger et al conducted a similar systematic review on the reliability of spinal palpation and found reliability to be acceptable ($\kappa = 0.40$) for pain provocation tests and motion palpation tests, but not for soft-tissue testing.[16]

Tests of the sacroiliac joint. Three systematic reviews were identified.[17–19] The review by Hansen et al (2007) was an update of an earlier review.[19] Hansen et al assessed, among other things, the diagnostic accuracy of the history and physical examination in the diagnosis of sacroiliac joint pain, which was confirmed by local anaesthetic block.

In total, eight studies were identified which evaluated various provocative tests, including the distraction test, compression test, thigh thrust test, Patrick's sign, and Gaenslen's test. In short, the evidence for accuracy of provocative manoeuvres in diagnosing sacroiliac joint pain is limited.

Hancock et al (2007) evaluated seven studies of the sacroiliac joint as the source of low-back pain. No single manual test seemed to be useful, including the thigh thrust or sacral thrust test. However, a combination of the tests seemed to be useful.

Tests of the facet joint. Hancock et al[17] examined the diagnostic accuracy of the following tests: 'Revel's criteria' (age >65 years, pain relieved by recumbent posture, and absence of pain exacerbation with coughing, forward flexion, rising from sitting, hypertension, or extension rotation), any of these aforementioned seven signs alone, the absence of centralization, traumatic onset, intra-articular degeneration on computed tomography (CT), various aspects of the medical examination, and 'clinical prediction rules'. In short, the authors conclude that tests of the facet joint as the source of pain have limited or no diagnostic validity. Studies of 'Revel's criteria' found conflicting results.

Evaluation of the disc as a source of pain. Hancock et al[17] identified 28 primary studies which investigated the diagnostic accuracy of various tests in identifying the disc as a source of low-back pain. The tests that were examined included magnetic resonance imaging (MRI) findings, the centralization phenomenon, response to vibration testing, ultrasound (annular tear), radiographs (narrowing), pain drawings, status of the posterior annulus identified on MRI, and isolated findings from the history and physical examination. In short, centralization was the only clinical feature found to increase the likelihood of the disc as a source of pain, while the absence of degeneration on MRI was the only test found to reduce this likelihood. The studies were found to be of moderate methodological quality.

Scientific evidence: neck

One systematic review examined orthopaedic tests of the neck for diagnosing cervical radiculopathy.[20] Only six studies fulfilled the inclusion criteria, which evaluated five provocative tests of the neck. The authors concluded that a positive Spurling's, traction/neck distraction, and Valsalva's might be used to establish the diagnosis of cervical radiculopathy, while a negative upper-limb-tension test might be used to rule it out. Only one study was found to have been conducted in the primary-care setting, which is the setting in which these tests are most likely to be conducted. This study was of poor quality, and therefore provided insufficient evidence.

Comments

It is quite remarkable that while many named orthopaedic tests of the neck and low back are often illustrated in orthopaedic textbooks, there is little evidence to support their diagnostic accuracy, and therefore their use in clinical practice. Consistent with clinical experience, many studies have demonstrated that the physical examination serves primarily to confirm suspicions raised during the history. Vroomen et al found, for example, in a study of the diagnostic value of the history and physical examination in patients with suspected lumbosacral nerve-root compression, that the predictive ability of their multivariate analyses were only slightly improved when physical examination findings were added.[21]

Special studies

Problem definition

In the initial period of symptoms, the vast majority of subjects will have recovered or show signs of recovery; therefore, additional testing in many cases is not necessary. Special studies should be considered much later and can be generally divided into two categories: (1) tests which provide evidence of physiological dysfunction (e.g. electrodiagnosis to identify neurological dysfunction, laboratory testing to identify inflammation or other systemic illness); and (2) tests to identify potential anatomic reasons for the complaint (e.g. plain-film imaging to rule out a fracture, or advanced imaging to identify a herniated lumbar disc, spinal stenosis, tumour, or abdominal mass).

Scientific evidence: low-back

Diagnostic imaging. Four systematic reviews were identified that evaluated the diagnostic accuracy of diagnostic imaging for low-back pain.[22–25] One systematic review found that degeneration – defined by the presence of disc-space narrowing, osteophytes, and sclerosis – was associated with non-specific low-back pain, but odds ratios were low (range 1.2–3.3). Spondylolysis and spondylolisthesis, spina bifida, transitional vertebrae, spondylosis and Scheuermann's disease were not associated with low-back pain. The authors concluded that there is no firm evidence for the presence or absence of a causal relationship between radiographic findings and non-specific low-back pain.

Another review evaluated the diagnostic accuracy of imaging for patients with low-back pain in primary-care settings.[22] Sensitivity and specificity of MRI were highest for cancer and infection, and slightly higher for herniated discs compared with other diagnostic imaging tests. The authors concluded that for adults younger than 50 years of age with no signs or symptoms of systemic disease, symptomatic therapy without imaging is appropriate. For patients 50 years of age and older, or those whose findings suggest systemic disease, plain radiography together with standard laboratory tests can almost completely rule out underlying systemic diseases. Advanced imaging (e.g. CT, MRI) should be reserved for patients who are candidates for surgery, or in those in whom systemic disease is strongly suspected.

Other reviews on invasive techniques, such as discography[24] and single photon emission computed tomography (SPECT) bone imaging for low-back pain[23], concluded that the use of these techniques in most patients with low-back pain is not supported by empirical evidence.

Two recent randomized controlled trials evaluated the role of radiography in primary-care patients with low-back pain. The use of lumbar spine radiography prior to treatment in primary care was not associated with improved function, reduced pain or improved overall health status after treatment, and was associated with an increase workload for the general practitioners.[26] Participants receiving x-rays were more satisfied with their care, but were not less worried or more reassured about serious disease causing their low-back pain. The other trial found that physicians and patients preferred rapid MRI over x-rays.[27] However, substituting rapid MRI for x-ray did not reduce pain and disability levels 12 months after the original examination, and resulted in increased costs.

Diagnostic blocks: nerve root. One systematic review examined the diagnostic accuracy of selective nerve-root blocks for patients with spinal disorders.[28] Nine studies were

Table 3. Summary of the evidence on diagnostic procedures for neck and low-back pain.

History	
Low-back	Four systematic reviews were identified which investigated the following in relation to the history: sciatica, red flags, specific low-back pain, and pain drawings. Emphasis should be placed on the response to pain with coughing, sneezing, and straining, a feeling of coldness in the legs, and urinary incontinence. For the identification of malignancy, a combination of age $\geq$50 years, a previous history of cancer, unexplained weight loss, and a failure to improve after 1 month of presentation had high sensitivity. An older review determined that history combined with an elevated ESR had a high diagnostic accuracy for serious spinal pathology. There is insufficient evidence that unusual pain drawings or extensive marking can be used to identify a disturbed psychological state.
Neck	No systematic reviews were identified.
Physical examination	
Low-back	Three systematic reviews were identified, one of which specifically examined the diagnostic accuracy of the SLR. In general, the SLR was the only sign consistently reported to be sensitive for sciatica due to disc herniation; however, it is limited by its low specificity, but has adequate intra- and inter-observer reliability. The diagnostic accuracy of other neurological signs and tests, such as crossed SLR and other nerve-root tension signs, is unclear. Spinal palpation: Four systematic reviews were identified. In general, pain-provocation tests have sufficient reliability; however, motion palpation tests, or determination of instability or other tests have either undocumented or low reliability. The evidence for the accuracy of provocative manoeuvres for diagnosing SI joint pain or facet joint pain is limited.
Neck	One systematic review was identified on orthopaedic tests for radiculopathy. A positive Spurling's, traction/neck distraction, and Valsalva's can be used to establish a diagnosis of cervical radiculopathy, while a negative upper-limb tension test can be used to rule it out.
Special studies	
Diagnostic imaging	
Low-back	Four systematic reviews were identified. There is no firm evidence that the presence or absence of radiographic abnormalities are associated with non-specific low-back pain. For patients $\geq$50 years of age, plain radiography together with standard laboratory tests can almost completely rule out underlying systemic disease. Advanced imaging should be reserved for candidates for surgery, or in whom systemic disease is strongly suspected. The use of invasive techniques such as discography and SPECT bone imaging is not supported by the evidence. Two RCTs evaluated the role of plain-film radiography in the primary-care setting: In general, use of radiographs was not associated with improved outcomes, but did result in increased costs and workload to the general practitioner.
Neck	No systematic reviews identified
Diagnostic blocks, facet and SI joint injections	
Nerve root	One systematic review was identified. There is moderate evidence for the accuracy of transforaminal epidural injections in the preoperative evaluation.
Facet joint	One systematic review was identified. There is strong evidence for the diagnostic accuracy of facet joint blocks in evaluating spinal pain.

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Table 3 (*continued*)	
SI joint	One systematic review was identified. There is moderate evidence for the specificity and validity of the accuracy of injections for determining SI joint pain.

RCT, randomized control trial; ESR, erythrocyte sedimentation rate; SLR, straight-leg raise; SI joint, sacroiliac joint; SPECT, single photon emission computed tomography.

identified which examined patients with sciatica. The sensitivity and specificity ranged from 45% to 100%, and the authors concluded that it may be an effective technique for evaluating patients with multilevel pathology in order to ascertain which level is the pain generator. The review also concluded that there is moderate evidence of transforaminal epidural injections in the preoperative evaluation for patients with either a negative or inconclusive imaging study.

Diagnostic blocks: facet joint. A recent systematic review was identified that evaluated the diagnostic accuracy of facet joint injections for chronic spinal pain.[29] The review identified 17 studies which evaluated the validity, prevalence, and false-positive rate of facet joint blocks. Based upon this review, the authors concluded that there is strong evidence for local anaesthetic facet joint medial-branch blocks in the diagnosis of low-back pain (nine studies on lumbar facet joint pain). The false-positive rate ranged from 17% to 47% for those with lumbar pain.

Diagnostic blocks: the sacroiliac joint. Three systematic reviews were identified.[17–19] Two reviews identified seven studies which evaluated the diagnostic accuracy of sacroiliac joint injections.[18,19] In short, there is moderate evidence for the specificity and validity of the accuracy of injections. Diagnostic imaging is not accurate for determining sacroiliac joint pain. Hancock et al determined that a positive bone scan seems to be useful for identifying the sacroiliac joint as a source of low-back pain. However, it has low sensitivity, meaning many subjects will have a false-negative result, or in other words, many with pain from the sacroiliac joint will have a negative bone scan.

Scientific evidence: neck

Diagnostic imaging. No systematic reviews were identified which examined the diagnostic accuracy of diagnostic imaging in subjects with neck pain.

Diagnostic blocks: facet joint. One systematic review was identified that evaluated the diagnostic accuracy of facet joint injections for chronic spinal pain, including those with neck and thoracic pain.[29] The systematic review concluded that there is strong evidence for local anaesthetic facet joint medial-branch blocks in the diagnosis of neck pain (five studies on cervical joint pain). The false-positive rate ranged from 27% to 63% for those with cervical spine pain.

Selective nerve-root blocks (SNRBs). One systematic review examined the diagnostic accuracy of SNRBs for patients with spinal disorders.[28] A sub-analysis of the results revealed two studies which examined patients with cervical radicular pain. One study

demonstrated a positive surgical response with a positive nerve-root block. In a second study the investigators were interested in dermatomal mapping with SNRB. They found that referral patterns differed in some cases from the classic dermatomal maps. However, the authors conclude that while SNRB may be helpful as a diagnostic tool, there is limited evidence of its effectiveness.

Practice points

There is sufficient sound evidence from systematic reviews (summarized in Table 3) to make the following recommendations:

- the history is principally for triage, during which 'red flags' should be identified and 'yellow flags' assessed
- the presence of multiple red flags should raise clinical suspicion and indicates the need for further investigation
- the physical examination is used to confirm suspicions from the history
    - in the case of lumbar radiculopathy, decreased muscle strength and sensory loss are relatively well correlated, while the straight-leg raise is a valuable test
    - in the case of cervical radiculopathy, tests such as Spurling's can be used to make the diagnosis, while others, such as the upper limb tension test, can be used to rule it out
- in patients $\geq$50 years of age, plain spinal radiography together with standard laboratory tests are highly accurate in identifying underlying systemic disease; however, plain spinal radiography is not a valuable tool for non-specific neck or low-back pain
- there is strong evidence for the diagnostic accuracy of facet joint blocks in evaluating spinal pain, and moderate evidence for transforaminal epidural injections, as well as sacroiliac joint injections for diagnostic purposes

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