In the changing paradigm of modern medicine, with its major focus on evidence-based medicine, interventional pain physicians are forced to learn and practice evidence-based interventional pain medicine. The necessary ingredients to provide evidence-based care include:

- Precise definition of the problem diagnosis;
- Research of the best evidence;
- Critical appraisal of the evidence; and
- Consideration of the evidence and its implications, in the context of the patient’s condition, circumstances and values.

Although, basic understanding may appear not only easy, but simple, developing expertise with incorporation of evidence, and meticulous application of evidence to a patient’s situation is difficult and time consuming. Thus, an algorithmic approach, if developed properly, may assist a physician, in the clinical practice of interventional pain medicine.

**STRUCTURAL BASIS**

The structural basis of chronic low back pain has been well described (1). Facet joints have been implicated as responsible for spinal pain in 15% to 52% of patients with chronic low back pain in controlled studies based on the type of population studied and the setting (2). Controlled studies also have reported the prevalence of discogenic pain as 26% to 39% of patients suffering with chronic low back pain (3, 4). Similarly, controlled studies have shown the sacroiliac joint to be a source of back pain or referred pain, with a prevalence of 2% (3), 19% (5) and 30% (6) in selected population groups. Postlaminectomy syndrome or pain following operative procedures of the spine is also a common entity in modern medicine (7). However, the exact incidence and prevalence of postlaminectomy syndrome is not known. It is estimated that 20% to 30% of spinal surgeries may not be successful as a result of the surgery’s being inadequate, incorrect, or unnecessary. Poor outcomes also may result following a well-indicated and well-performed surgical procedure. Similarly, the role of ligaments, muscles and other structures in chronic low back pain has not been identified by controlled studies. A structural cause for chronic low back pain may be identified in only 15% of patients with radiological investigations, electromyographic studies, and physical and clinical examination. Bogduk (8) postulated that precision diagnostic injections could assist in arriving at a definite diagnosis in low back pain in approximately 70% to 80% of the patients based on studies by Schwarzer et al (4, 5, 9-12). Manchikanti et al (3) evaluated the relative contributions of various structures in chronic low back pain in 120 patients. Utilizing controlled precision diagnostic blocks, including disc injections, facet joint blocks, and sacroiliac joint injections, they showed that 40% of the patients were diagnosed with pain emanating from facet joints, 26% with discogenic pain and 2% with sacroiliac joint pain. Thus, utilizing controlled diagnostic blocks with an algorithmic approach allows a structure causing the low back pain to be identified in 68% of patients. Manchikanti et al (3) also showed that 13% of patients suffered with potential segmental dural/nerve root pain. If segmental dural/nerve root pain is considered as a reasonable alternative, structures responsible for chronic low back pain are identified in 81% of patients. However, this still leaves 19% of patients without an identified structure responsible for low back pain.

With published evidence and utilizing individual
experience, a physician may be able to develop an algorithmic approach for not only diagnosis, but also for management of chronic low back pain. However, practitioners should be aware of the literature and should not indiscriminately endorse or insert steps into the algorithmic approach for everything that can be done for diagnosis or management of chronic low back pain. Due to the complexity of chronic low back pain and differing opinions, the algorithmic approaches may disappoint some practitioners. In addition, these algorithms are not didactic and unambiguous. However, they may reflect an honest approach to the management of chronic low back pain: they do not prescribe what to do but indicate what the practitioner might or could do.

**DIAGNOSIS**

Making a diagnosis is a complex cognitive task that involves both logical reasoning and pattern recognition. In the first step, a physician would enumerate possibilities and estimate their relative likelihood. In the second step, in the diagnostic process, a physician would incorporate new information to change the relative probabilities, rule out some of the possibilities, and ultimately choose the most likely diagnosis. In the diagnosis of low back pain, there is also a third step leading to appropriate precision diagnostic injections. Further, in managing low back pain, a physician must consider which disorders or pain generators to pursue. If one considers all known causes equally and tests for them all simultaneously, then the patient would undergo unnecessary testing. This approach is also known as the possibilistic approach. However, more commonly clinicians are selective and consider first those disorders more likely, also known as a probabilistic approach, which is a prudent approach.

Manchikanti et al (3) utilized an algorithmic approach in evaluating the relative contributions of various structures in chronic low back pain, determining that the most common pain generator was the facet joint, followed by the intervertebral disc, with the sacroiliac joint a distant third. However, they were able to determine, with proven, standardized precision diagnostic injections, a painful structure in 68% of the patients. In this algorithmic approach, every patient underwent facet joint nerve blocks. The authors stated that they adapted this paradigm to avoid any confusion in the diagnosis. Further, this approach is also easier, and less expensive, with better patient acceptance. Manchikanti et al (3) contend that this algorithm avoids confusion in the diagnosis and also promotes ease, not only for the physician, but also for the patient. Manchikanti et al (3) in multiple investigations have shown that facet joints are most commonly involved, followed by the disc, even though all the investigations were done in one setting. An approach with an algorithm originating with discography as the primary or first procedure, before facet joint blocks, will be more involved and less productive; and patient acceptance will be different. Arguments surface that this is not a proper assessment of the relative prevalence of three conditions; namely, facet joint pain, discogenic pain and sacroiliac joint pain. Further, it is argued that this algorithmic approach has not been tested by others, and it may include inherent bias in starting with facet joint blocks and using discography only in patients who prove negative to facet joint pain. The question always remains what might have occurred if discography had been used first and facet joint nerve blocks had been applied only in discography-negative cases. At least in the United States, Manchikanti et al (3) believed that this was not a practical algorithm to approach.

Authors of guidelines endorsed by the International Spine Injection Society (13-18) suggest a different type of algorithm with the intervertebral discs as the most common pain generator, followed by the sacroiliac joint, followed by facet joints, which are entertained last in the algorithm because they are the least likely sources of chronic back pain in the working age population, with a prevalence of less than 15%, and probably closer to only 10%. Bogduk (14), in this description of an algorithm for the investigation of back pain, described it as designed to provide a disciplined approach to the use of invasive investigations for lumbar spinal pain, and to avoid haphazard behavior or investigations being undertaken essentially at the whim of a physician. He noted that, in this regard, the algorithm is predicated by the pretest probabilities of various conditions, and invites investigation of the more common conditions first, rather than pursuing any conditions arbitrarily. He described this recommendation as being based on the best available evidence, which indicates that amongst patients with chronic low back pain, internal disc disruption is the single most common cause, accounting for at least 40% of cases, and is far more prevalent than any other identifiable condition. Thus, in a patient with abnormal discs on magnetic resonance imaging (MRI), internal disc disruption is the most likely diagnosis, and in the interests of efficiency should be the diagnosis first pursued. It constitutes a waste of effort and resources to undertake other investigations only to prove them negative in patients in whom those other investigations were never likely to be positive (13). If the results of disc stimulation are negative, discogenic pain is excluded.
However, if the results of disc stimulation are not negative, and they are indeterminate, i.e., not convincingly positive, the algorithm recommends cessation of investigations. The second step in the algorithm is to investigate the sacroiliac joint. As per this algorithm, if the pain is located in the very midline, the available evidence indicates that patients with this sort of back pain defy the investigations encompassed by this algorithm. Therefore, the algorithm invites consideration of the propriety of pursuing investigations, and implicitly recommends that they cease. If the pain is bilateral, it is unlikely to be sacroiliac joint pain and the patient is more likely to have bilateral facet joint pain. The third question of the algorithm for sacroiliac joint pain evaluation is whether or not the patient’s pain is entirely caudal to the L5 level of the lumbar spine. If the patient’s pain is entirely caudal to L5, a sacroiliac joint block should be undertaken. If the block is negative, the patient is considered for facet joint blocks. If the block is positive, a confirmatory block should be undertaken. If the confirmatory block is negative, the algorithm recommends cessation of investigation, with the diagnosis remaining indeterminate.

This algorithm also recommends following Revel’s (19, 20) seven tests before proceeding with the facet joint blocks. Bogduk (13) believes that the tests do not establish that the patient does, indeed, have facet joint pain; but they do increase the likelihood to a modest degree. These tests require multiple negative features; however, the value of tests was nonexistent in the evaluation by Manchikanti et al (21). It is also stated that, because facet joint pain may arise from any of a number of segmental levels, multiple investigations may be required to detect a symptomatic joint. Bogduk (13) believes that the low prevalence of this condition means that the majority of such investigations will be negative and fruitless: it becomes inefficient to pursue facet joint pain, one joint at a time, only to exclude all joints in the majority of cases. Thus, this algorithm recommends a multilevel screening test.

Bogduk believes that this algorithm is very efficient. Using this algorithm, discogenic pain is excluded or confirmed with one step. Sacroiliac joint pain is excluded with one block, or confirmed with two blocks. In patients in whom sacroiliac joint pain is not suspected, facet joint pain is excluded with one step-a screening block-, or diagnosed with three steps:

- One screening block that is positive;
- One or two blocks at single levels to pinpoint the responsible joints; and
- One confirmatory block.

He described that, given the pretest probabilities:

- Internal disc disruption accounts for 40% of cases of chronic low back pain;
- Sacroiliac joint pain accounts for up to 20% of cases; and
- Zygaphophysial joint pain accounts for 10% of cases.

Under the algorithm, most patients would undergo investigations of their discs, with 40% proving positive and requiring no other investigations. Of the 60% remaining, not all will require sacroiliac joint blocks, but perhaps half will prove positive and will not require facet joint blocks. Facet joint blocks will therefore be indicated in perhaps only 30% of the original population. Perhaps half of these will prove negative on screening blocks. Only the remaining half should be subjected to multiple tests of the zygaphophysial joints. Accordingly, Bogduk (13) states:

- In about 30% of cases, sacroiliac joint pain will be diagnosed with one block plus a confirmatory block;
- In about 15% of cases, investigations will exclude sacroiliac joint pain and zygaphophysial joint pain with two blocks;
- Only 15% of cases may require up to four or five blocks to pinpoint a painful zygaphophysial joint.

A disadvantage of this algorithm is that most patients are subjected to discography, which is a painful procedure with low patient acceptance. A significant number of patients are also subjected to sacroiliac joint blocks.

However, the algorithm by Manchikanti et al (3) considers and demonstrates that facet joint pain gives the highest yield, followed by discogenic pain, and sacroiliac joint pain. The comparison of both propositions shows that discogenic pain is 40% versus 26%, sacroiliac joint pain is 20% versus 2% and facet joint pain is 10% versus 40%.

A modification to the described algorithm proposed by Manchikanti et al (3) would be to proceed with modifications based on findings of MRI, clinical features, and physical examination. Table 1 illustrates features of somatic and radicular pain. Fig. 1 shows the algorithm used by Manchikanti et al (3) in their publication. Fig. 2 shows a proposed algorithm for structural identification of low back pain. Fig. 3 shows the back pain algorithm as presented by Derby et al (16).

Thus, there are significant differences between both algorithms. While the algorithm of Manchikanti et al (3) considers and demonstrates that facet joint pain gives the highest yield, followed by discogenic pain,
Table 1. Features of somatic and radicular pain

<table>
<thead>
<tr>
<th>Causes</th>
<th>Somatic or Referred Pain</th>
<th>Radicular pain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>♦ Facet joint pain</td>
<td>♦ Disc herniation</td>
</tr>
<tr>
<td></td>
<td>♦ Sacroiliac joint pain</td>
<td>♦ Annular tear</td>
</tr>
<tr>
<td></td>
<td>♦ Myofascial syndrome</td>
<td>♦ Spinal stenosis</td>
</tr>
<tr>
<td></td>
<td>♦ Internal disc disruption</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>♦ Deep aching</td>
<td>♦ Sharp, shooting</td>
</tr>
<tr>
<td></td>
<td>♦ Poorly localized</td>
<td>♦ Well localized</td>
</tr>
<tr>
<td></td>
<td>♦ Back worse than leg</td>
<td>♦ Leg worse than back</td>
</tr>
<tr>
<td></td>
<td>♦ No paresthesia</td>
<td>♦ Paresthesia present</td>
</tr>
<tr>
<td></td>
<td>♦ Covers a wide area</td>
<td>♦ Well-defined area</td>
</tr>
<tr>
<td></td>
<td>♦ No radicular or shooting pain</td>
<td>♦ Radicular distribution</td>
</tr>
<tr>
<td>Modification</td>
<td>♦ Worse with extension</td>
<td>♦ Worse with flexion</td>
</tr>
<tr>
<td></td>
<td>♦ Better with flexion</td>
<td>♦ Better with extension</td>
</tr>
<tr>
<td></td>
<td>♦ No radicular pattern</td>
<td>♦ Radicular pattern</td>
</tr>
<tr>
<td>Radiation</td>
<td>♦ Low back to hip, thigh, groin</td>
<td>♦ Follows nerve root distribution</td>
</tr>
<tr>
<td></td>
<td>♦ Radiation below knee unusual</td>
<td>♦ Radiation below knee common</td>
</tr>
<tr>
<td></td>
<td>♦ No radicular pattern</td>
<td>♦ Radicular and shooting pain</td>
</tr>
<tr>
<td>Signs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory alteration</td>
<td>♦ Uncommon</td>
<td>♦ Probable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor changes</td>
<td>♦ Only subjective weakness</td>
<td>♦ Objective weakness</td>
</tr>
<tr>
<td></td>
<td>♦ Atrophy rare</td>
<td>♦ Atrophy possibly present</td>
</tr>
<tr>
<td>Reflex changes</td>
<td>♦ None</td>
<td>♦ Commonly described but seen occasionally</td>
</tr>
<tr>
<td>Straight leg raises</td>
<td>♦ Only low back pain</td>
<td>♦ Reproduction of leg pain</td>
</tr>
<tr>
<td></td>
<td>♦ No root tension signs</td>
<td>♦ Positive root tension signs</td>
</tr>
</tbody>
</table>

followed by sacroiliac joint pain, Bogduk and others (13-18) show the highest yield for discogenic pain, followed by sacroiliac joint pain, and facet joint pain. Obviously, there are differences of opinion. However, there are also similarities. Both algorithms consider controlled diagnostic blocks as the essential criterion. A modified algorithm described in Fig. 2 may also have similar implications as the algorithm proposed by Bogduk and others.

Based on the proposed algorithm, if one follows the algorithm proposed by Bogduk and others, in 100 patients, the results would be as follows:

- Almost 100 patients would undergo investigation of their discs with provocative discography.
- Of the remaining 60 patients, (40 are considered positive for internal disc disruption), approximately 45 of the patients will undergo one sacroiliac joint block and an additional 25 to 30 will undergo two blocks.
- The remaining 40 will undergo at least one set of facet joint blocks with lidocaine, with an additional 20 undergoing a second confirmatory block.

- Fifteen patients may undergo four to five blocks to pinpoint a painful zygapophysial joint.

Thus, the total number of sets of blocks appears to be 240 to 260 with the algorithm proposed by Bogduk and others.

In contrast, based on the algorithm proposed by Manchikanti et al (3) (Fig. 1), the sequence and total number of injections will be as follows:

- All 100 patients will undergo at least one set of facet joint nerve blocks; 68 patients will also undergo a second confirmatory block.
- Since 40% were considered positive for facet joint pain, approximately 50 to 60 patients will undergo provocative discography.
- Of the remaining 34 patients, 26 of whom were considered to be positive for discogenic pain, approximately 14 to 16 will undergo a screening sacroiliac joint block, followed by an additional 5...
Fig 1. An algorithmic approach utilized by Manchikanti et al (3) for diagnosis of chronic low back pain

Chronic low back pain without disc herniation

Facet joint nerve blocks (lidocaine)

Positive facet joint nerve blocks (bupivacaine)

Diagnosis: Facet joint pain

No SI joint features

Provocative discography

Positive with concordant pain and a negative disc(s)

Diagnosis: Discogenic pain

Negative

SI joint features

SI joint injection (lidocaine)

Positive SI joint blocks (bupivacaine)

Negative

Epidural injection

Positive facet joint nerve blocks (lidocaine)

Positive facet joint nerve blocks (bupivacaine)

Discogenic pain

Sacroiliac Joint pain

Provocative discography

Positive

Negative

Discogenic pain

Epidural injection
to 6 patients undergoing a confirmatory block. Thus, the total number of blocks in this algorithm ranges from 240 to 260. Even though there appear to be an equal number of blocks with this algorithm, the discograms are much fewer, excluding discograms and substituting with facet joint and sacroiliac joint blocks, which are more innocuous and less expensive. However, if the modification shown in Fig 2 is followed, the number of blocks probably will be reduced to even less than with both algorithms.

Whatever approach is utilized, it appears that following an algorithmic approach for diagnosis is prudent and yields better results than haphazard practice.

**MANAGEMENT**

As with diagnosis, an algorithmic approach may be utilized for management of chronic low back pain based on the diagnosis and various steps as described above.

**REFERENCES**

6. Maigine JY, Aivakiklis A, Pfefer F. Results of sacroiliac joint double block and value of sacroiliac pain provoca-
Fig 3. An algorithmic approach to chronic low back pain as proposed by Derby et al (16)

Begin with posterior column unless obvious structural cause

Synovial joint algorithm

Facet

SI Joint

Hip

Steroid injection surgical consult RIT Prolo

Manipulation RIT-Prolo Rhizotomy

No relief

RIT-Prolo or

Neurotomy Medial Branch/ Dorsal root

- Radiofrequency
- Standart
- PRT
- Cryotherapy
- Chemical

No relief

Disc W/U

>75% relief

Repeat 6 months to 1 year PRN

>10% relief

Repeat Add RTI-Prolo

Anterior column

Discography protocol

Disc

>50% height collapse

50% height collapse

>50% height collapse

Radial annular tear

Significant protrusion (approx.4-5mm)

- IDET
- Nucleoplasty
- Combine IDET/ Nucleoplasty

- Nuclear
- Decompression
- Percutaneous extraction
- Suction
- Laser
- Nucleoplasty
- Chymopapain
- Combine IDET/ Nucleoplasty

- Synovial joint algorithm

- Disc Injection

- Steroid
- RIT-Prolo with Eek solu-