

## Algorithm for Management of Low Back Pain and Sciatica

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### Abstract

**Background:** Low back pain and sciatica are one of the most common complaints that face clinicians in spine outpatient clinics. The process of examination and reaching a diagnosis is not always easy. Planning treatment that suits each case needs a surgeon that has the knowledge and tools to tackle the different diagnosis.

Introduction of new concepts about low back pain and sciatica with improved clinical examination findings that will lead to more accurate clinical diagnosis. Using the algorithm will reach to a diagnosis that needs imaging only for confirmation.

**Aim of Study:** This algorithm aims at simplifying diagnosis and management of low back pain and sciatica putting in mind treatment options including endoscopic techniques.

**Patients and Methods:** Four hundred patients were included in the study; they were examined according to the algorithm in the outpatient clinic of Al-Helmya Military Hospital during the period from January 2020 to December 2020.

**Results:** The diagnosis reached by using the algorithm coincided with the MRI findings in 93% of cases and the success rate of the treatment methods used was 89%.

**Conclusion:** Using a systematic approach to diagnosis and reaching a treatment plan has proved successful in the management of low back pain and sciatica.

**Key Words:** *Low back pain – Sciatica – Algorithm – Spine endoscopy.*

### Introduction

**MANAGEMENT** of back and leg pain is evolving and changing due to a better understanding of the patho-anatomy well correlated with its pathophysiology. This has resulted in a shared decision making involving patient and surgeon, focused on a broader spectrum of surgical as well as non-surgical treatments, and not just masking the pain generator [1].

It has moved away from decisions based on diagnostic images alone, that, while noting the image alterations, cannot explain the pain experienced by each individual as images do not always show variations in nerve supply and patho-natomy [2].

This has also resulted in better pre-surgical planning with more specific and defined goals in mind [3].

#### *Epidemiology:*

LBP is the most expensive, benign condition in industrialized countries. Experts have estimated that approximately 80% of people will experience LBP during their lifetimes. The annual prevalence of LBP is 15-45% with a point prevalence of approximately 30%. Sixty percent of those who suffer from acute LBP recover in 6 weeks and up to 80-90% recover within 12 weeks; however, the recovery of the remaining patients with LBP is less certain [4,5].

#### *Pathophysiology:*

The initial change in cases of disc degeneration is an annular tear. The tear may leak and cause inflammation around the nerve root or DRG. The weakened annulus may give rise to a subsequent herniation through this tear, so we must target the fragment, annular tear and the leak from the tear.

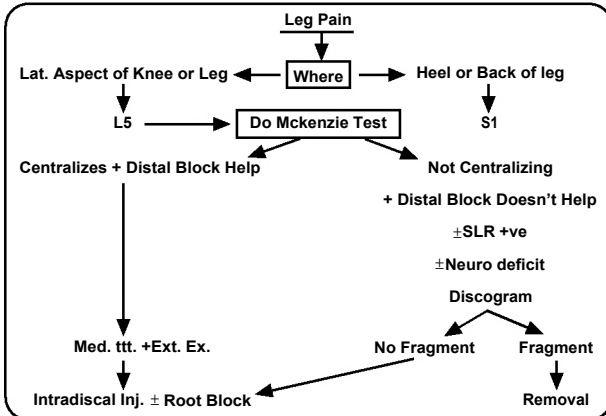
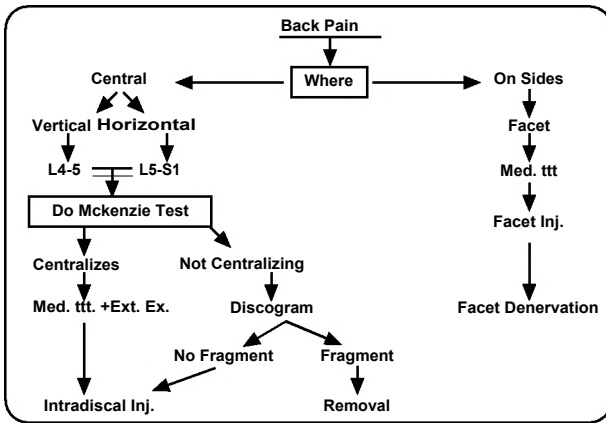
Physiologically, the inflammation gives rise to mechano-sensitization of the nerve roots and DRG, which requires removal of the embedded disc fragments in the annulus to allow that torn annulus to heal [2].

The location of the pain and its distribution is also not always in the expected dermatome or even on the ipsilateral side of the patho-anatomy. The inflammatory membrane can cause pain in an adjacent dermatome or even a distant dermatome

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like groin pain produced while working at L4-5 or L5-S1 [4,22].



NB: Any combination of back pain and leg pain could be present and treatment is as such.  
 \*Centralizes = Pain coming to one spot in the back rather than spreading or going down the leg.  
 Ext. Ex. = Extension Exercises, Ing.=Inj ection, Med. ttt=Medical treatment.

**How to use the Algorithm:**

**1st: Take short history:**

C/o mainly: Back pain or leg pain.

- Back pain where (center or sides) discogenic or facet.

Is it longitudinal (L4-5) or transverse (L5-S1).

- Leg pain where dermatomal and referral areas/ constant or increase with walking exclude claudications.
- Any associations that increase or decrease pain (special position).
- Past history: Diabetes causes neuropathy, operation as decompression discectomy, fixation, abscess evacuation or any treatment trial before.

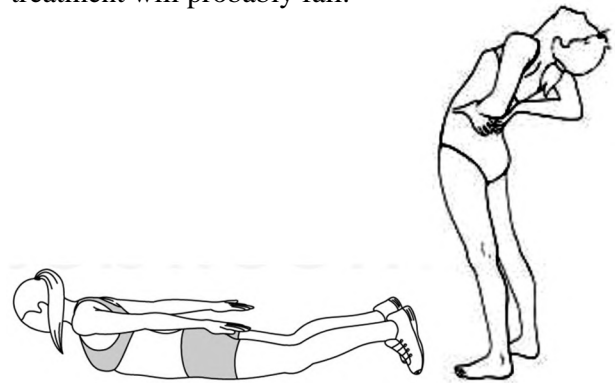
**2nd: Examination:**

**1- Mckenzie test:**

Used to test the integrity of the annulus.

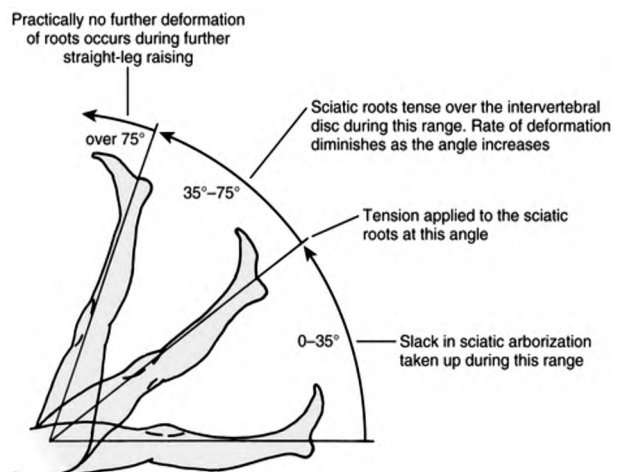
Provocation test for patients with back pain and more specific low back pain. The purpose of this test is to see whether the patient has pain while doing this pain provocation test and whether the pain centralizes in the back or spreads in the back/ goes down the leg [7].

The patient is asked to lie prone and extend the back, if the pain centralizes then the torn annulus has the capability of healing and a trial of conservative treatment is given but if the pain spreads in the back or goes down the leg then this annulus is incapable of spontaneous healing and conservative treatment will probably fail.



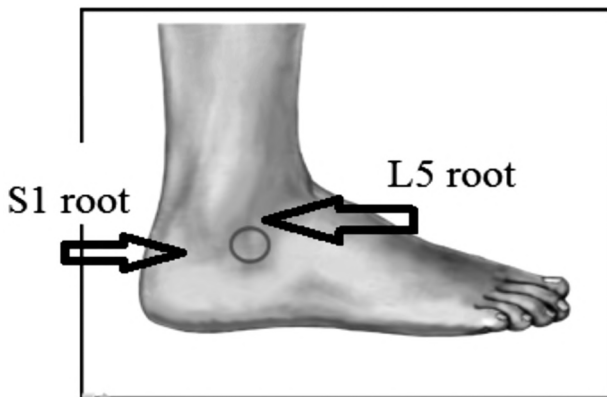
**2- SLR (straight leg raise test):**

Neurodynamic tests check the mechanical movement of the neurological tissues as well as their sensitivity to mechanical stress or compression. These tests, along with relevant history and decreased range of motion, are considered by some to be the most important physical signs of disc herniation, regardless of the degree of disc injury. SLR is a neural tension test that can be used to rule in or out neural tissue involvement as a result of a space occupying lesion, often a lumbar disc herniation. It is one of the most common neurological tests of the lower limb [8,24].



### 3- Gore sign:

A tear in the annulus lead to leak from the nucleus which causes inflammation. Inflammation leads to mechano-sensitization of nerves & up regulation of sodium channels which causes the pain. Nociceptors in the DRG are pseudounipolar cells which mean that their axons centrally & peripherally are affected in the same way. This is the principals for the Gore sign, the distal block at the ankle & foot. We have utilized the Gore sign to differentiate the inflammatory from mechanical compression of the nerve roots at L4-5 & L5-S1. By palpation of L5 root termination (deep peroneal nerve) in sinus tarsai, S 1 root termination behind the lateral maleolus (sural nerve) you will find tenderness according to which root is inflamed [1].



### 3rd: Investigations:

*Basic:* As X-ray or more advanced as CT.

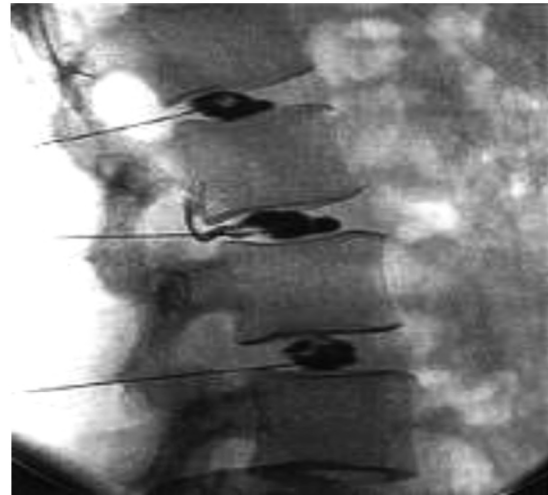
Give an idea about bony structure.

*Advanced:* MRI give an idea about soft tissue [9,20,23].

### *Invasive: Discography:*

This procedure is most frequently used to determine if degenerative disc disease is the cause of a patient's pain (discogenic low back pain). In this procedure, the discographer inserts a needle in the patient's back into the center of the disc. Radiographic dye is then injected into the disc, and if injecting the dye recreates the patient's normal pain (concordant), it is then inferred that the specific disc is the source of pain for the patient. If the pain is unlike their normal pain (discordant) it can be inferred that even though the disc may look degenerated on an MRI scan, it is in fact not the source of the patient's pain. The test itself is painful, but the patient needs to be awake and aware in order to tell the discographer what kind

of pain is generated by the injection. It will also show the fragment and the tear leaking the dye [14].



### 4th: Treatment options:

#### 1- Try medical treatment:

Medicines are commonly prescribed for the treatment of sciatica, specifically, low-quality evidence indicates that NSAIDs do not appear to improve immediate pain and all NSAIDs appear about equivalent. Evidence is also lacking in use of opioids and muscle relaxants by usual means. In those with sciatica due to piriformis syndrome, botulinum toxin injections may improve pain and or function. There is little evidence for steroids, either epidural or by pill. Low-quality evidence supports the use of gabapentin for acute pain relief in those with chronic sciatica [12,19].

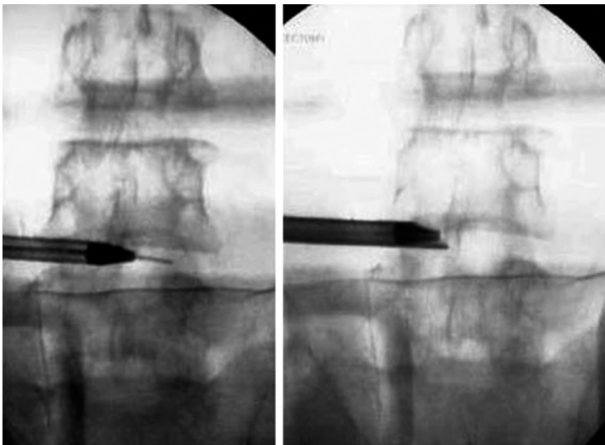
#### 2- Injection of Facet/nerve root/disc:

Facet joint injections are best performed using fluoroscopy for guidance to properly target and place the needle (and to help avoid nerve injury or other injury) [16].



3- Endoscopic DD (decompression discectomy) ± Foraminoplasty [17]: General Indications for TFE (Transformational Endoscopy):

- 1- Annular tears with discogenic lumbar pain as determined by evocative discography, both positive and false negative.
- 2- All disc herniations and protrusions accessible through the foramen whether contained, extruded or sequestered.
- 3- Extraforaminal Herniations.
- 4- FBSS from foraminal fibrosis, recurrent HNP, and subarticular lateral recess stenosis.
- 5- Mild and soft tissue central spinal stenosis.
- 6- Foraminal and extraforaminal stenosis.
- 7- Foraminal osteophytosis
- 8- Discitis.
- 9- Juxtafacet and pedunculated cysts.



### Patients and Methods

#### Study criteria:

This study was done using standard methodology outlined in the Cochrane Handbook and reported the findings in accordance with the statement guidelines.

After ethical committee approval, all patients signed an informed and detailed consent before examination.

A total number of 400 consecutive patients diagnosed with chronic low back pain syndrome in Al-Helmya Military Hospital with last follow-up December 2020. They had pre-diagnostic X-ray and MRI imaging studies.

#### Inclusion criteria:

*The design:* Prospective study.

*Population:* Patients of all ages with low back pain and sciatica symptoms.

*Procedure:* Clinical diagnosis using Algorithmic approach, Mckenzie test & Gore sign.

*Outcome measures:* Greater than or equal to one pre-specified quantifiable outcome measure (they included measures of clinical and radiological outcomes).

*Level of evidence:* Provides level IV of evidence.

#### Exclusion criteria:

- 1- Cases that had previous back surgery.
- 2- Cases with multilevel disc prolapse.
- 3- Cases lost during follow-up.

#### Type of included participant:

Patient with low back pain and sciatica symptoms.

#### The primary outcome:

Reaching to diagnosis.

#### Secondary outcome measures:

Refer non related cases.

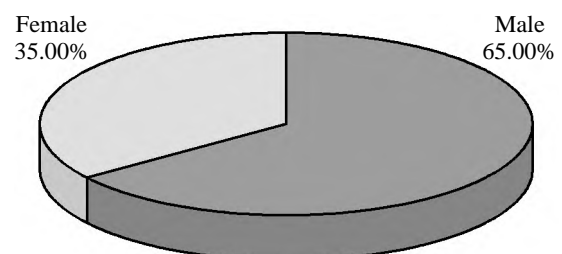
### Results

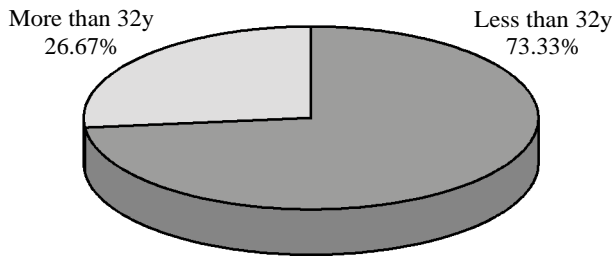
In this prospective study, we used the algorithmic approach on 400 patients complaining of low back pain and sciatica symptoms.

Making full assessment including history, examination and investigations.

#### I- Demographic data:

There were 140 females and 260 males with a mean age of  $32.6 \pm 8.1$  (range 20-60 years).



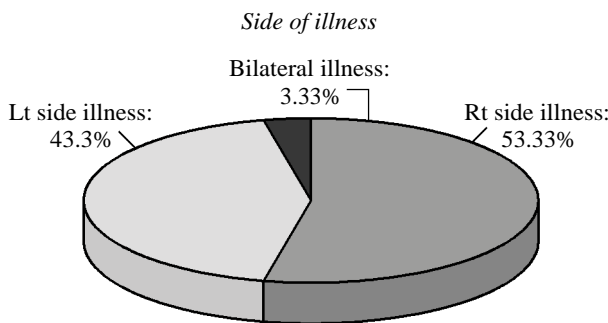


**II- Hospital data:**

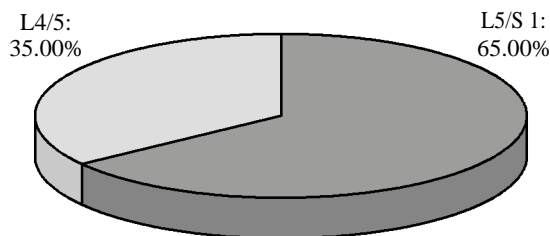
In clinic examination using the algorithmic approach, X-rays and MRI master sheet.

**III- Clinical evaluation:**

- 1- The duration months of illness in patients was (12.3±7.26) ranging (3-36m).
- 2- Left sided radicular pain (172 cases) about 43.3% while right sided radicular pain (212 cases) in 53.33% and bilateral radicular pain (16 cases) in 3.33% of patients.

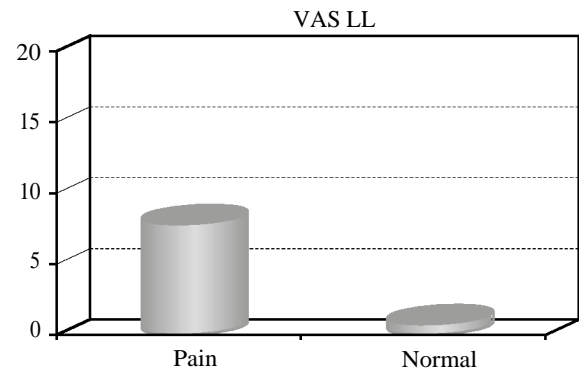


**3- Distribution of the affected levels among studied groups:**



**4- Pain Score:** Scoring of back pain and sciatica were done using visual analogue score.

Pain assessment scores statistics. *p*-values statistically significant (<0.05), it indicates strong evidence against the null hypothesis, as there is less than a 5% probability the null is correct (and the results are random).



**IV- Radiological evaluation:**

|                 | X-Ray      | MRI        | Algorithm  | Total       |
|-----------------|------------|------------|------------|-------------|
| N               | <b>400</b> | <b>400</b> | <b>400</b> | <b>1200</b> |
| ΣX              | 333.9      | 341.46     | 428.9      | 1104.26     |
| Mean            | 11.13      | 11.382     | 14.2967    | 12.27       |
| ΣX <sup>2</sup> | 3893.11    | 4075.9102  | 6219.21    | 14188.2302  |
| Std. Dev.       | 2.4691     | 2.5557     | 1.7357     | 2.6805      |

| Source          | SS       | df | MS      |          |
|-----------------|----------|----|---------|----------|
| Between-options | 185.86   | 2  | 92.9328 | F=17.825 |
| Within-options  | 453.5851 | 87 | 5.2136  |          |
| Total           | 639.4508 | 89 |         |          |

The f-value is 17.825. The *p*-value is <0.001. The result is significant at *p*<0.05 Sum squares (ss), degree of freedom (df), Mean Square (MS).

The *p*-value is the level of significance within a statistical hypothesis test so:

- 1- Our *p*-value between options indicates that the results of the algorithm are significant in relation to the other results given by MRI about 93%.
- 2- Our *p*-value within options indicates that the results of the algorithm are significant in relation to the other results given by post-treatment by 89%.

**V- Correlation of Algorithm with clinical and radiological finding:**

On measuring the correlation of the algorithm with clinical finding we used VAS as an indicator to patient comprehensive clinical state and used correlation coefficient as measure of dependence between two subjects to establish a line of best fit through a dataset of two variables and indicate how far away the actual dataset is from the expected values.

We find a significant correlation of the algorithm usage measuring correlation coefficient that give assume values in the range from >0 to +1 can indicate a predictive relationship that can be exploited in practice.

*Master sheet example:*

| Case N | Age | Sex | VAS lower limb | Symp duration (ms) | Side (LL) | Level (L) |
|--------|-----|-----|----------------|--------------------|-----------|-----------|
| 1      | 42  | M   | 8              | 12                 | R         | 4/5       |
| 2      | 56  | F   | 7              | 8                  | R         | 5/S1      |
| 3      | 22  | M   | 8              | 36                 | L         | 4/5       |
| 4      | 44  | F   | 6              | 6                  | L         | 4/5       |
| 5      | 44  | F   | 8              | 9                  | R         | 4/5       |
| 6      | 22  | M   | 8              | 24                 | R         | 5/S1      |
| 7      | 25  | M   | 7              | 18                 | L         | 5/S1      |
| 8      | 33  | F   | 4              | 7                  | L         | 4/5       |
| 9      | 21  | F   | 6              | 36                 | R         | 4/5       |
| 10     | 21  | M   | 7              | 12                 | L         | 5/S1      |
| 11     | 27  | M   | 8              | 3                  | R         | 5/S1      |
| 12     | 40  | M   | 4              | 12                 | R         | 4/5       |
| 13     | 24  | M   | 5              | 3                  | R         | 5/S1      |
| 14     | 38  | F   | 4              | 14                 | L         | 5/S1      |
| 15     | 40  | F   | 7              | 7                  | R         | 4/5       |
| 16     | 56  | F   | 6              | 9                  | L         | 4/5       |
| 17     | 29  | M   | 4              | 10                 | L         | 4/5       |
| 18     | 57  | F   | 8              | 14                 | R         | 5/S1      |
| 19     | 23  | M   | 4              | 12                 | L         | 5/S1      |
| 20     | 26  | M   | 6              | 4                  | R         | 5/S1      |
| 21     | 25  | M   | 7              | 3                  | L         | 5/S1      |
| 22     | 42  | F   | 6              | 13                 | R         | 4/5       |
| 23     | 23  | M   | 8              | 4                  | R         | 4/5       |
| 24     | 50  | F   | 7              | 12                 | R         | 5/S1      |
| 25     | 55  | F   | 6              | 7                  | L         | 5/S1      |
| 26     | 49  | M   | 8              | 8                  | R         | 4/5       |
| 27     | 60  | F   | 6              | 12                 | R         | 5/S1      |
| 28     | 38  | M   | 8              | 18                 | R         | 5/S1      |
| 29     | 55  | F   | 8              | 12                 | L         | 4/5       |
| 30     | 47  | M   | 9              | 10                 | L         | 4/5       |

*Summary & Conclusion:*

Degenerative disc disease may result in back pain with or without radiculopathy. Diagnosis is achieved by clinical assessment, plain radiography and MRI.

This study was aiming to use simple algorithmic approach to reach diagnosis in low back pain and radicular symptoms.

The results of this study were recorded, presented in tables and charts and statistically analyzed. There was correlation between the MRI studies that confirm the algorithmic approach in about 93%.

The 7% of patients that did not correlate with the algorithm in their diagnosis were treated according to the levels that were found on the MRI by the same principles of treatment but were not included in our treatment results.

In a military setting like Al-Helmia Hospital the systematic diagnosis and treatment process proved to be of utmost importance in the rapid

turnaround of patients and their return to work as the process is simple and easy.

*Limitations:*

- 1- Choice of patient reported outcome measures as our primary outcome measure is important in obtaining a patient centered focus in comparing these methods.
- 2- Statistical result is a clue not a sure tool of superiority.
- 3- During the review process modifications to the inclusion criteria needed to be made in order to include the available literature on our research question.

*Recommendations:*

- 1- Introduce standardized and reproducible educational programs for algorithm performance and interpretation.
- 2- Continued utilization to aid about the spine given the enhanced landmark identification and accuracy.
- 3- Additional studies comparing diagnostic ability of algorithm against CT and MRI.
- 4- The best method of algorithm education is continuous practicing usage.
- 5- Applying the 10 point scoring system for algorithm usage reliability. (More than 7 point= Reliable usage).

*Scientific:*

- 1 Interobserver reliability.
- 1 Intraobserver reliability.
- 1 Universality.
- 2 Disease specificity.

*Utility:*

- 1 Ease of application.
- 1 Simplicity.
- 1 Patient tolerability.

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## خوارزمية:

### علاج آلام أسفل الظهر وتوتر عرق النسا

آلام أسفل الظهر أصبحت أكثر الأمراض الحميدة تكلفة في الدول المتقدمة، حيث أظهرت الإحصائيات أن ٨٠٪ من الأشخاص يعانون منه على الأقل مرة واحدة خلال حياتهم.

تهدف الخوارزمية إلى تبسيط تشخيص آلام أسفل الظهر وتوتر عرق النسا مع الوصول للطريقة الأمثل للعلاج بما فيها مناظير العمود الفقري.

أصبح الآن الفهم الأفضل لمسببات آلام أسفل الظهر من الناحية التشريحية والفسيو لوجيا والباثولوجية يساعد كثيراً في الوصول إلى تشخيص أفضل وأدق.

إن استخدام الخوارزمية يساعد على الوصول إلى تشخيص وطريقة العلاج دون الإستعانة بالأشعة التشخيصية واستخدام الأشعات فقط لتأكيد ما تم التوصل إليه.