



Low Back Pain: A Comprehensive Review on the Diagnosis, Treatment Options, and the Role of Other Contributing Factors

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Abstract

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BACKGROUND: In recent years, low back pain (LBP) is a growing major health issue around the world and mostly addressed in primary healthcare settings. This may be due to changing work environment including the nature of long sitting work hours, especially in the booming information and technology (IT) and Business Process Outsourcing (BPO) industry. LBP is normally considered as a combination of various types of pain and its related conditions, which eventually lead to disabilities.

AIM: In this article, the aim is to discuss the current and future perspectives of LBP mainly on diagnosis and therapeutic front of LBP.

METHODS: A search was performed using electronic databases, which include PubMed Central and Google Scholar, using the related key words "back pain and low back pain." All related peer reviewed published articles were included regardless of the language, region, or the publication date.

RESULTS: Although the management of LBP both in terms of diagnosis as well as in the therapeutic options has witnessed considerable progress but challenges are still exist not only within countries but also in the regions and continents among various medical professionals. However, in the past few years, a huge array of coordinated but randomized multi-center clinical studies were performed and various detailed insight investigations have been done, and substantial clinical guidelines have become available. Hence, a new view on evidence-based management approach for LBP has significantly improved recently and discussed here.

CONCLUSION: Based on the available evidence and literature, this comprehensive review discusses the present and future perspectives of LBP mainly on diagnosis and therapeutic front for LBP. In addition, current intervention and prevention plans have failed to lessen the considerable burden of LBP and hence several areas which require more details, which deserves additional discussion to augment us through an understanding of this very important topic on improvements of multi tasked outcomes to benefit the affected patients.

Introduction

Low back pain is a growing global chronic problem, which normally affects musculoskeletal system [1] and accounts for huge healthcare spending for affected individuals, mostly elderly people and indirectly for nations around the world on their healthcare expenditure [2]. Until now, a structured physical exercise regimen or timely interventions on issue basis are highly recommended as an effective management for persistent long-term LBP; however, recent investigations have shown that the exercise regimen has lessen the pain temporarily or decreasing pain for the moment only [3], [4]. On the other hand, this physical activity-oriented intervention specifically reduces the risks involved among chronic LBP cases but these options were not acceptable to pain therapists. The reasons are unknown or not clear till now, why these physical activities related preventive strategies failed to alleviate chronic LBP and associated economic burdens and disability [5].

Back pain (BP) is broadly classified into three major categories. They are characterized as acute one if it lasts for 6 weeks or less than that duration, sub-acute condition is ranging between 6 weeks to 3 months period, whereas the chronic pain is measured if it persists more than 3 months period [6]. Back pain is normally viewed as persistent chronic problem mostly affects elderly people (80%) and have huge impact on their day today activities. However, in recent years, it is viewed as an uprising devastating condition among technocrats working in the information technology (IT) and BPO sectors and bring direct and indirect loss of economy as well as quality of life but exists in their life for some duration [7], [8], [9], [10]. To support this, numerous contributing factors are identified and proposed for rapid origin of pain such as muscle sprain and strain, which are instigated by any type of accidents, longer sitting hours, and weight lifting activities [11]. Besides the above, numerous disease conditions such as scoliosis, osteoporosis, and arthritis or other circumstances may also contribute to the formation of LBP [6]. However, after thorough assessment and evidence on causes

and reasons, medical practitioners in this field suggest/recommend either surgery or other therapeutic options to combat LBP, which include chronic types of pain [11].

It is well established that LBP is widely viewed as a common problem that brings the affected persons to pain professionals [6]. In this regard, numerous therapeutic options are available for LBP, which are extremely valuable when it is employed together with other standard adjuvant therapeutic modalities employed by well-trained medical professionals who are an expert in analyzing affected persons anatomy and physiology of pain [12]. Besides the above, pain managing experts are currently equipped with the necessary skills to alleviate the LBP by employing delicate advanced methods and procedures. However, for various reasons, the above measures failed to bring success in the form of therapeutic as well as other forms of intervention by a patient for LBP can have several variables [10].

Although the management of LBP both in terms of diagnosis as well as the therapeutic options has witnessed considerable progress, challenges are still existing not only within countries but also in the regions and continents [12]. Despite these challenges, steady growth has been made in understanding of BP and related contributing factors like social, psychological and genetics. These new knowledge with technology advancements have provided motivation for the development of new diagnostic procedures, evidence-based screening methods and more targeted interventions, which underline the necessity for a multidisciplinary approach to the management of LBP that integrates not only biological but also psychological and social aspects [13].

Hence, in the present article, we comprehensively review and discuss about LBP and its associated pathophysiology, diagnosis, and available treatment options. This review highlights the role of genetic factors that specifically modify intervertebral disc stability and pain signaling that may independently impact on the risk of developing chronic BP and also explores the evidence and current therapeutic options available and benefits associated with non-surgical options for LBP. In addition, this review broadly addresses risks and contributing factors associated with acute and persistent LBP; response and recovery options employed and finally focused on new innovative physical activity-oriented efficacy if any in pain management specifically for aged population.

Genetic Contributions in LBP

The demonstration of LBP is predisposed by either structural, psychosocial, or professional factors [14]. Besides, additional factors such as

biochemical and inflammation also contribute to the evolution of acute toward chronic pain, more importantly genetic or hereditary factors may influence on any of these contributing factors [15]. In line with this, recent investigations have been largely engaged on genes which determine bone and cartilage structures, which are demonstrated by morphological signs using magnetic resonance imaging (MRI) [16]. The following signs were found to be associated with genetic contributions like disc height narrowing, disc herniation [17], [18], and various other descriptions related to LBP, which include duration of severe episode of LBP and related hospitalizations associated. However, the estimates for these heritability variables for LBP vary ranging from 30 to 45% [16].

Although, till now, only few genetic influences were caused by genes, which affect disc degeneration suggests that genes involved in pain perception, signaling, and psychological processing [19], and genetic variants of immune genes [20], [21] contribute to the proportion of heritability of chronic BP. The genetic variability in pain signaling pathways contributes to the variance in pain sensitivity and the individual response to treatment strategies [19].

Diagnostic Approaches Employed in Pain

The current diagnostic tools generally aimed at focusing on LBP affected patients of both specific as well as non-specific cases [12]. Specific low back pain (SLBP) is generally characterized by multiple symptoms like various types of fractures, infections and bone, and joint problems exhibited by the affected patients, which is evident by reports of multiple clinical investigations [12]. On the other hand, non-specific low back pain (NLBP) is defined by signs or symptoms elicited without any particular cause, normally by unknown or non-specific origin [22]. Nearly 90% of NLPB patients' symptoms were characterized in the clinical settings based on diagnosis with the exclusion of specific pathology [23], [24].

Although various diagnostic as well as therapeutic strategies are currently adopted for managing NLBP, the following approaches [24], [25], [26], [27] are employed by general practitioners such as lumbago, physiotherapists focus on hyperextension and chiropractors' faces joint problems and finally, orthopedic surgeons' focal point is degenerative disc issues [24], [26]. Although, we have to admit that at present there are no unique and reliable classifying systems exist for majority cases of NLBP, in the clinical practice as well as highlighted in various literatures, NLBP is still viewed as the existence of the complaints [24], [28].

Role of Advanced Therapeutic Approaches in the Management of Pain

Based on the above fact, it is necessary and required to introduce various advanced techniques available in the healthcare settings such as fluoroscopy technique that may revolutionize various novel interventional therapeutic options for long persistent pain by providing superior precision to the needle position [12] or by employing newly available digital subtraction angiography imaging technique or unintended intrathecal placements of needles may avert death in the form of injury to the intra-spinal structures like, nerve roots, blood vessels and spinal cord [29], [30]. Although, most of BP conditions do not require surgery as an option because various other modes of therapeutic options such as home remedies or by employing alternative medicines and changes in personal lifestyles may improve or alleviate back pain related complications as these options may provide temporary relief until the person may opt for other permanent therapeutic choices which include surgical procedures [25], [29].

Alternative Therapeutic Options and their Role in the Management of Pain

Although, LBP management differs from person to person, it is not logic to expect that all patients will respond to the same treatment approach, and no single therapeutic intervention is generally completely effective for all patients. Consequently, limited studies are used to manage the pain of one or more interventions guided by evidence and efficacy, while aiming to reduce overall costs [31], [32]. Pharmacological therapies, physical and rehabilitation treatments, psychiatric treatments, complementary and alternative medicine approaches, and percutaneous approaches that are minimally invasive are relevant courses of care. The overview of the pain management specifically both acute and chronic LBP is explained in Table 1.

Spinal Manipulation

Spinal manipulation (SM) is otherwise called spinal manipulative therapy or manual therapy [33] (Figure 1). SM technique is extensively used for the treatment of LBP and has been recognized in several randomized controlled trials. The aim of this technique is to relieve pressure on the joints, reducing inflammation, and enhancing nerve function. The fact that they achieve a pop or cracking sound inside

Table 1: Management of Acute LBP (without serious pathology)

- Initial reassurance, advice on staying active and avoiding bed rest, and self-management advice.
- Self-management for low back pain can include self-exercises and information from reading pamphlets or participating in online education.
- Therapeutic exercises, superficial heat, Kinesio taping, and manual therapy are some of the most common conservative physical treatments.
- Recommendations for returning to normal activities or a referral to an individual or group therapy program.
- For short period of time, pharmacological treatments including nonsteroidal anti-inflammatory medications (NSAIDs) and mild opioids are recommended (paracetamol is not recommended).
- In 7–14 days, the progress should be reviewed.

Management of Chronic LBP (without serious pathology)

- A clinical assessment (patient history, physical or clinical examination, and neurological tests – to recognize radicular features) is used to triage patients.
- To rule out significant pathologies, patients should be checked for "red flags," and diagnostic tests (such as imaging) should only be performed if they are suspected.
- To predict poor outcomes, patients should be assessed for psychosocial risk factors ('yellow flags' such as low self-efficacy, fear of movement, and catastrophizing).
- Education and self-management, as well as the resumption of normal activities and exercise, are indicated as non-pharmacological and non-invasive management treatments, with the addition of psychosocial programs for individuals whose symptoms persist (multidisciplinary treatments).
- Walking, yoga, tai chi, Pilates, and progressive relaxation are some of the most used conservative physical treatment routines (manual therapy, relaxation techniques, massage, in some guidelines).
- There is no evidence that one sort of exercise is better than another.
- Patients' preferences and the treating therapist's experience may influence the final decision.
- Passive physical therapy (spinal mobilization, massage, acupuncture, and spinal manipulation) is rarely recommended, or in some guidelines, is optional.
- Passive approaches (rest and drugs) are associated with worsening disability, and are not recommended.
- Nonsteroidal anti-inflammatory medicines (NSAIDs) and antidepressants, if needed, should be used at the lowest effective dose and for the shortest time possible.
- Denervation techniques, injections, and surgical procedures are generally discouraged.
- If there is no improvement after four weeks, or if pathology or radiculopathy is suspected, an orthopedic specialist should be consulted.

synovial joints is the key feature of SM techniques. The explanation for this audible release is subject to some debate, but it is generally agreed to reflect a spinal facet joint cavitation [34]. A systematic analysis concluded that it is clinically better than sham therapy in the terms of reducing short-term pain and disability from chronic LBP [35]. The mode of action can be classified into biomechanical, neurophysiological, and psychological aspects. The thoughts behind the SM cause biomechanical variations within the spine, which in turn cause physiological changes.



Figure 1: Demonstrates spinal manipulation and illustrate the central anterior glide with pisiform contact

It is expected that it can influence the amount and type of sensory input obtained by the central nervous

system (CNS). This is because the SM activates the organs of the Golgi tendon and afferent muscle spindle. SM is also believed to change the excitability of motor neurons and affect reflex neural outputs [36]. SM, in addition, has a psychological effect on patients. It was found in a systematic analysis that SM enhanced pain and psychological effects relative to verbal treatments [37]. In a current systematic review and meta-analysis examining the impact of SM and mobilization on the cardiovascular parameter, it was shown that spinal manipulation and mobilization could significantly reduce systolic and diastolic blood pressure [38]. A common intervention administered in patients with LBP is SM to the lumbar spine. Sixty-three percent of 984 LBP patients registered immediate pain improvements following SM [39]. Manipulations have also been suggested to have shown better results when researching and measuring experimentally induced pain compared to exercise, education, and other treatment measures [40].

Acupuncture

Manual Acupuncture (MA) is one of the most commonly used treatment methods in Traditional Chinese Medicine (TCM) [41], which is mainly used for a variety of pain and other disorders. Acupuncture has been described as a treatment technique involving one or more needles entering the skin without an injection [42]. The physiological effects of needling in particular body points are thought to be characterized by the activation of endogenous pain control mechanisms [43]. The dorsal horn, which can trigger or inhibit those points on the body that induce the release of opioids including serotonin and catecholamine, is inhibited by this technique [44], [45]. These neurotransmitters have different effects, such as anti-inflammatory, analgesics, muscle relaxants, and antidepressant effects [43]. Electroacupuncture (EA) is another form of acupuncture that uses an electric current to enhance the effects of the needles [46]. Low frequencies are commonly recommended when using electro-acupuncture in patients with LBP to achieve a quicker analgesic and anesthetic than conventional manual acupuncture, as shown by the physiological reaction [47]. Furthermore, the effects of a standardized amount and quality of stimulation, which can be accomplished by controlling the duration and range of the input current, can be helpful for pain in general [48].

Weight Loss

Weight reduction is commonly prescribed in people with spinal pain who are overweight or obese as

a therapeutic strategy to reduce pain and disability [49]. Obesity has been a worldwide epidemic in recent years. Obese subjects are commonly categorized by musculoskeletal disorders and particularly by Chronic NLBP. Inactivity exacerbates LBP pathology, weight gain, and physical deconditioning, which is a major concern for LBP [50]. Inactivity decreases intervertebral discs space and increases the content of paraspinal muscle fat, the severity of pain, and the level of disability [51]. Clinically, several exercise plans for LBP have been reviewed, but few have focused on overweight people or Quality of Life (QOL) outcomes. Isolated therapeutic exercises [52], [53], manual therapies [54], [55], [56] and exercise with integrated therapies (cognitive behavioral therapy, alternative therapies, and nutrition) [55], [57], [58], [59] are among the several programs examined. A sedentary lifestyle triggers an increase in LBP, deconditioning, anxiety avoidance, and functional limitations [60]. By enhancing pain symptoms, physical activity, and fear-avoidance behaviors, regular exercise may help to break the cycle [61], [62]. As self-efficacy and health development, longer-lasting participation exercises will increase energy expenditure and activity levels [63]. The better results of controlling the LBP are QOL and perceptions of functionality [64], [65].

Physicians face a daunting challenge when it comes to prescribing exercise to help this population overcome LBP and participate in everyday activities [64]. While studies indicate that various exercise strategies improve health outcomes in overweight people with LBP, their efficacy outside of the clinical study setting is uncertain due to personal costs, stigma, and a lack of access to facilities or trainers. In the successful recovery of obese patients with a number of chronic pain problems, lifestyle modification remains a core instrument. Such interventions include educating the obese subjects on the importance of diet, weight loss, behavior changes, and modifying the level of physical activity [62].

Anti-inflammatory Drugs

Nonsteroidal anti-inflammatory (NSAIDs) drugs are also commonly used first-line analgesic agents for LBP treatment. Both acute and chronic LBP requires pharmacological care. For short-term relief, acetaminophen, and NSAIDs have been shown to be effective [66], [67], [68]. At doses up to 4 g/day, acetaminophen does not display a significant difference in analgesia for acute pain as compared to NSAIDs. Although, for pain relief, acetaminophen is significantly lower than NSAIDs for CLBP [69]. Non-selective and COX-2 selective NSAIDs have also been shown to be more effective than placebo in acute and chronic LBP,

with no significant difference in efficacy between the two types of NSAIDs [68], [70]. Because of the risk of systemic renal, cardiovascular, and gastrointestinal side effects, it is recommended that NSAIDs be used at the lowest effective dose for the shortest time possible [69], [70]. Skeletal muscle relaxants for acute LBP have also been shown to be successful. Analgesia is preferable to placebo in two-week trials, but there is no clear distinction between specific muscle relaxants [67] [70].

Posture Correction

Poor posture and long hours of sitting are the risk factors of LBP, including lumbar disc degeneration and herniation, arthritis, cervical spur, and spinal deformity [71]. While sitting, the average individual's thighs and torso form a nearly 90-degree angle and the pelvis tilts backward in a sitting position and forward in a standing position [72], [73], [74]. Slouched posture can cause the effect of function in the digestive and respiratory systems, reduce the space of the chest and abdomen, and contribute to an unbalanced body which leads to LBP [75]. Evidence indicates that many people experience signs of perceived body discomfort during prolonged sitting, especially in the buttock and lower back regions. Discomfort has contributed to increased muscle fatigue during prolonged sitting, decreased intervertebral disc space, nutrition, and decreased muscle oxygen and blood flow [70]. In contrast with other sitting postures, prolonged sitting in the forward-leaning position substantially increased pain in the lower back region [76]. There are many treatments approaches available today for the control of LBP, such as posture correction, manual therapy, exercise therapy, electrotherapy, patient education, and ergonomic modifications [75]. In everyday life, habitual inappropriate posture with low muscle activity influences both the volume and strength of the lumbar muscle [71], [73]. Thus, exercise programs are effective in reducing pain and discomfort, enhancing physical function, and increasing individuals' oxygenation and blood flow to the lower back [75].

Besides, prolonged inactivity is also known to contribute to a reduction in muscle strength, spinal flexibility, and QOL. Previous research has shown that 40-64% of people subjected to have LBP during prolonged standing, even though they do not have it before [77]. Long periods of standing require the back extensors to stay engaged for an extended period of time, which can lead to muscle fatigue [78]. Excessive metabolic waste development and accumulation as a result of prolonged static contraction may cause fatigue [79]. Many treatments strategies, such as stretching exercises, muscle strengthening, and

flexibility training may have a significant positive impact on posture. In addition to that, several CLBP postural rehabilitation methods, such as the Global Postural Rehabilitation (GPR) process, are focused on muscular kinetic chains, while others, such as the McKenzie (MK) method is based on biomechanical approaches [80], [81], related to the structure of the lumbar intervertebral disc (IVDP) during flexion and extension movements. The American College of Physicians' guidelines specifically link good efficacy of Tai-chi exercises, Pilate's method, and Yoga postures to therapeutic exercise recommendations; the Nice guidelines also recommend the MK method, core stability exercises, hydro-kinesiotherapy, the Feldenkrais method, and aerobic exercises, while the Alexander method appears to be efficient [82], [83]. All the above treatment methods are supporting postural correction methods either directly or indirectly.

Core Stability Exercise

In recent years, several clinical trials focusing on core stability exercise and lumbopelvic stabilization programs have been performed, with the majority of them indicating that exercise therapy is superior to any other treatment for CLBP (such as Spinal Mobilization, conservative physical therapy treatment, advice to stay active movement, and no treatment) in reducing pain, increasing muscle strength, post-treatment impairment, and long-term function [84], [85], [86], [87]. In core stabilization exercises, Rectus and Transversus abdominis (TrA), lumbar multifidi, and other abdominal, diaphragmatic, paraspinal, and pelvic muscles are targeted. Different studies in patients with CLBP have been reported delayed activation of TrA with respect to erector spinae with severe multifidus atrophy [88]. It was first proposed that spine instability is likely to be caused by any dysfunction of the structures of either spinal passive (non-contractile) or active (trunk muscles) or by decreased neural control over these two sections, and that instability could lead to LBP. Spine instability may cause excessive strain of the tissue and lead to pain. Panjabi assumed that the trunk muscles should be actively contracted to compensate for the lack of passive stabilization. It has been shown that muscle cocontraction improves trunk stability [89].

Transcutaneous Electrical nerve Stimulation (TENS)

Therapeutic treatment of LBP patients is challenging [90]. Pharmacological therapy is routinely

prescribed to minimize the effect of LBP on the everyday lives of individuals. However, inappropriate and non-optimal drug prescribing is common [91], [92]. Non-pharmacological therapy, such as hot packs, and transcutaneous electrical nerve stimulation (TENS) can help these patients [93], [94]. TENS is a cost-effective method of treatment that delivers electrical impulses through the skin. TENS stimulates a diverse neuronal network that activates downward inhibitory systems, minimizing hyperalgesia [95], [96]. There is growing evidence that sensitized central pain mechanisms explained the transition from acute to CLBP [97], [98]. In a subgroup of patients undergoing CLBP, signs of central sensitization (CS) have recently been reported. To clarify the efficacy of this modality, a few theories have been advanced. The theory of gate control indicates that TENS can prevent pain pathways from functioning in the dorsal horn of the spinal cord [99]. In addition, stimulation of the nervous system through transcutaneous electrodes is believed to modify pain perception and cause the release of endogenous analgesic substances such as endorphins [100], [101]. TENS is a relatively risk-free procedure with minimal side effects (e.g., patients with pacemakers, breastfeeding, sinus carotid use) and skin irritation is the most common side effect due to the TENS electrodes, which can be reduced by using non-irritant gels [98]. For training in the procedure, the patient needs to visit the hospital. Given the cost, this is an excellent value for money, if a small percentage of patients are able to live a productive life, back to their work without any hindrance, administer their own therapy at home, time-consuming, and avoid more expensive treatment [92].

Hydrotherapy

Hydrotherapy (Aquatic Exercise) for patients with LBP is an alternative form of treatment. Physiotherapy is now increasing with several specialties such as hydrotherapy used to treat the low back disorder for a few days [102]. While there is no specific problem or illness that can be established as the cause of chronic NLBP, hydrotherapy can help to relieve pain and improve physical well-being [103]. Chronic NLBP can be effectively treated with hydrotherapy, which is a natural alternative treatment option. The effectiveness of hydrotherapy would give subjects great gain in improving the QoL and decreasing disabilities [104]. Several authors conducted research on hydrotherapy for LBP. The effect of aquatic exercise on the treatment of CLBP is that it improves the QoL and disability of CLBP patients and is a better alternative to land-based exercises [105]. The properties of hydrotherapy reduce pain, decrease muscle spasm, improves joint range of motion, strengthen the weak muscles, enhances circulation, and improves balance and coordination

when these exercises are performed in water [106]. In addition, the combination of buoyancy and water resistance properties makes the joint better mobility and eliminates limitations than on ground exercises [107]. The heat and floatability of water will act on thermal receptors and mechanoreceptors to block nociceptors and have a positive effect on spinal segments [108]. Hydrotherapy special properties minimize joint tension and the axial loading of the spine [109]. The buoyancy of the water allows a greater range of motion by supporting body weight, and changing the depth helps to develop resistance [110]. The aquatic environment enables the subject to perform activities that would be difficult or impossible on land, and it has been shown that the optimal exercise strength can be accomplished by controlling the speed of motion in water [111].

Stress Management

Physical and psychological stress, individual characteristics, and poor general health are known risk factors for LBP [112]. Stress, anxiety, and depression release cortisol through the endocrine, and nervous systems. Cortisol is a pulsatile stress hormone that is released in the bloodstream and is responsible for many catabolic processes in the body. Spinal stimulation can momentarily interrupt homeostatic processes in people with LBP. Chronic LBP may trigger physiological stress, resulting in the body releasing uncontrolled levels of cortisol [113]. Cortisol induces a catabolic state in the metabolism in stressful and painful conditions. People with chronic pain who are constantly stressed tend to have higher cortisol levels than healthy people [114]. In addition to pain sensitivity, elevated levels of cortisol associate with lower lumbar muscle power [115]. Therefore, cortisol has been used in studies involving people with LBP as a biochemical marker [115], [116]. Some studies indicate that physical activity can reduce stress and cortisol levels efficiently [117]. In individuals with chronic LBP, physical activity programs such as yoga [118], aquatic and stretching exercises have shown significant results in lowering cortisol levels [115]. Yoga exercises have thus been used as a conservative physical activity tool to decrease chronic LBP and stress [119], [120], [121]. Regular high-intensity aerobic exercise often raises the pain threshold and functional capacity in individuals with LBP, according to (Chatzitheodorou *et al.*, 2007) [122], but does not display a decrease in serum cortisol levels.

Kinesio Taping

Kinesio Taping (KT) (Figure 2) is a commonly used trending therapy in patients with LBP. KT is



Figure 2: Indicates Kinesio taping for low back pain

thin and has elastic, skin-like mechanical properties to allow for a normal range of motion. In 1973, KT was developed by Kenzo Kase [123]. Kinesio taping has been suggested to provide cutaneous stretch stimulation, which may interfere with the transmission of mechanical and painful stimuli while also providing afferent stimuli, enhancing pain inhibitory mechanisms (gate control theory), and reducing pain [124], [125]. KT has beneficial effects on disability and functional activities in cases of LBP [126], [127], [128], [129]. Kase *et al.*, 1996 [130], developed a theoretical structure to explain the immediate improvement in lumbar pain-related disability after using KT. It was believed that when a muscle is hypertonic, it activates the transmission of information to the CNS by the Golgi receptors, where inhibitory motor neurons are stimulated, and that this process can therefore be triggered by stimulating the Golgi receptors by applying KT. KT increases the flexion range of motion in healthy subjects [131] and patients with LBP [127], [128], [131]. It has been shown that KT also increases the endurance of the back extensor muscles [127], [130].

Footwear

Paying attention to your footwear can help to prevent LBP. When standing or walking, the only part of the body that hits the ground is the feet. As a result, they have the ability to alter standing posture as well as the application of forces and gestures [132]. Footwear acts as a bond between the feet and the ground, enabling this connection to be altered. Different

biomechanical interventions at the foot level have been utilized to improve LBP. Foot mechanics abnormality is closely related to irregular pelvic rotation during gait, leading to muscular dysfunction and lumbopelvic strain [133]. Different shoe inserts, insoles (viscoelastic or prefabricated), and custom-made foot orthotics were previously studied with reductions of LBP in specific populations with pronated standing foot posture [134], and female staff with static standing duties [135]. High heel shoes increase lumbar lordosis and compressive pressures on the lumbar lordosis, all of which lead to lumbar spondylosis. High heeled shoes have an effect on cervical and lumbar muscle activation and on postural control as well [136], Trunk muscle activation is necessary for balance and postural control. Trunk muscles provide support in situations where the body's balance is challenged [133], [135]. There is an increased disruption of body balance with high heeled shoes, and trunk muscle has to act more to preserve body balance. As health-care professionals, we should identify these threats and should be creating awareness among the living population.

Conclusion

Although the steady increasing burden of LBP specifically sub-acute and chronic cases represent the real challenge and of dire concern to various sector of population. The available literature still unable to adequately identify the core problems associated with high-risk patients, who may be vulnerable and become chronic once they failed to address the issues on time. To support this fact, there are no universal primary or secondary prevention and management measures have been demonstrated. Moreover, the risk of potential side effects should also be carefully weighted. In this regard, individual patient's preferences should be taken into account, before starting any available therapeutic interventions. In summary, based on the available literature the current comprehensive review provided a clarity and confidence in the diagnosis, assessment on the therapeutic interventions and their effectiveness for sub-acute and uprising chronic LBP cases. However, one has to realize that LBP is a difficult condition, which will continue to rise and affect millions of populations every year. In the coming years, it will continue to target aged people but also young technocrats that may make huge economic loss and compromise quality of life.

Key recommendations

Based on the various available diagnostic and therapeutic approaches, we attempt to provide the following practical, evidence-based recommendations. These recommendations are promising interventions

not only to improve patient safety and reduce LBP but also to identify gap areas for future research in this field.

1. Most patients with acute or subacute low back pain should start with nonpharmacologic treatment, such as superficial heat or hot packs, acupuncture, massage, or spinal manipulation, because they will recover with time regardless of treatment.
2. Nonsteroidal anti-inflammatory medications (NSAIDs) or skeletal muscle relaxants should be utilized when pharmacologic treatment is sought.
3. For most patients with chronic low back pain, nonpharmacologic treatments such as spinal manipulation, cognitive behavioral therapy, posture correction, motor control exercise, therapeutic exercises, multidisciplinary rehabilitation, mindfulness-based stress reduction, acupuncture, yoga, tai chi, progressive relaxation, low-level laser therapy, or biofeedback should be used first.
4. NSAIDs should be used in patients with chronic low back pain who do not respond to nonpharmacologic treatment. Patients who do not respond to or tolerate NSAIDs should be considered for tramadol or duloxetine. Opioids should only be used if all other options have failed and the potential benefits exceed the hazards for a specific patient.

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