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Epidemiology and Risk Factors for Spine Pain

Devon I. Rubin, MD[a,b,*]

[a]*Mayo Clinic College of Medicine, 200 First Street, SW, Rochester, MN 55905, USA*
[b]*Department of Neurology, Mayo Clinic, 4500 San Pablo Road, Jacksonville, FL 32224, USA*

Pain in the low back and neck is one of the most common medical problems in the adult population. It is estimated that between 70% and 80% of adults experience an episode of low back pain at least once during their lifetime [1,2]. This high prevalence and widespread nature of the problem affect physicians throughout the medical specialties and it is estimated that between 2% and 5% of the population seeks medical attention annually because of back pain. Patients seek medical consultation not only from their primary care physicians but also from various physician and nonphysician subspecialists, including neurologists, neurosurgeons, orthopedic surgeons, physiatrists, rheumatologists, physical therapists, and chiropractors. In many instances, patients who have back and neck pain make up the largest proportion of patients for many of these specialists. Furthermore, it is estimated that back pain is the most common reason for limitation of activity in the younger population and is the most frequent cause of absences from work [1,3–5].

Although the evaluation and treatment of back pain is one of the most common reasons for patients to seek medical attention, accurate assessment of the true incidence and prevalence is difficult. The literature is full of studies performed during the past several decades focusing on the epidemiology of back and neck pain. The wide methodologic variability of the studies, however, poses several challenges in interpreting the results. For example, the cohorts from which the epidemiology of back and neck pain have been studied vary widely and have consisted of patients in the general population or in subpopulations (such as those seen in general medical practices or in specific work environments), in largely or sparsely populated cities, in the United States or in other countries, in young or old individuals, and in

* Department of Neurology, Mayo Clinic, 4500 San Pablo Road, Jacksonville, FL 32224.
E-mail address: rubin.devon@mayo.edu

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individuals involved in a variety of occupations. Another interpretive challenge lies in the inconsistency and lack of standardization of the case definition used to define back pain in different studies, the criteria used to define the severity of the symptoms, and the variability in the duration of low back pain used in the studies. Attempts to standardize the definition of back pain have led to improvements in the quality of the studies, but even with standardized definitions, comparisons are difficult. Furthermore, most studies rely on self-reporting the experience of back or neck pain, which is subjective and prone to inaccuracies because of reliance on patient recollection. As a result of these many variables, extrapolating the results of the studies in the literature to determine the most "accurate" prevalence and incidence rates is difficult and generalizing the findings may be impossible.

Regardless of the exact prevalence of back and neck pain, spine problems undoubtedly pose a major medical problem to society. There are many different causes of back pain; however, a specific cause rarely is identified in the majority of patients. Nonetheless, the identification of factors that may lead to increased risk for development of back or neck pain is important to ultimately guide individuals who may be more predisposed to experiencing pain in the use of potential preventative measures. This articlea article reviews the epidemiology and risk factors for neck and back pain. Because neck pain is less common and disables a smaller proportion of the population than low back pain, the epidemiology and risk factors for neck pain are studied much less extensively than for low back pain. As a result, the focus of the article predominantly is on low back pain.

Epidemiology

The burden of low back and neck pain to society can be estimated in epidemiologic studies evaluating the prevalence and incidence of the conditions. The prevalence refers to the number of patients in a population who experience pain at a certain point in time. Prevalence can be defined as the number of people who have pain at a defined point or period of time divided by the total defined population during that time. Prevalence is measured at a single point in time (point prevalence) or over a specific period of time (period prevalence), such as during 1 month, 1 year, or throughout an entire lifetime (cumulative lifetime prevalence). The incidence refers to the number of patients who experience a new episode of pain over a specific period of time, such as over a 1-year period. Although both parameters assess the burden of the problem, estimation of the incidence focuses on new-onset or first-time development of acute back or neck pain.

Incidence of developing back pain

Most studies that focus on the epidemiology of back pain have concentrated on identifying the prevalence, but the incidence for developing

a new episode of pain also has been studied. The annual incidence of developing an episode of low back pain is reported as low as 4% and as high as 93% [6–8]. In an epidemiologic survey of adults, ages 20 to 69, in Saskatchewan, Canada, 19% of 318 individuals who did not have a history of back pain over a period of 6 months before the study developed an episode of low back pain over a 1-year period, and most episodes were reported as mild in severity [8]. In another population-based study of adults from a single small town in Israel, a similar 1-year incidence of 18% was found for developing low back pain that interfered with regular daily activities and lasted at least 24 hours [9]. When assessed over a 3-year period, the incidence of developing low back pain of any degree or duration in 148 randomly selected Veterans Affairs (VA) outpatients was 67%, whereas 44% self-reported experiencing an episode of "moderately severe" pain [10].

Contrary to the high rates reported in some studies, a longitudinal study of adults in a Canadian population demonstrates the risk for developing new onset of back pain over 2 years to be only 8% for males and 9% for females, with an overall incidence of approximately 45 per 1000 person years [11]. Similarly, a large study of more than 2000 adults who were free of low back pain during the month before the study found a 12-month cumulative incidence of only 3% to 5% for a new episode of low back pain for which patients consulted a physician. The 12-month cumulative incidence was approximately 30% for an episode of back pain, however, for which patients did not consult a physician [6]. These studies suggest that the incidence of developing any type of back pain over a 1- to 2-year period may be high, whereas that of developing pain that is more severe and limits daily activities or requires medical attention is lower.

Prevalence of low back pain

One of the challenges in comparing different studies on prevalence of back pain is the variation in study populations and in the many factors that may affect the development of back pain. For example, differences in the ages of the populations studied, activity level, psychosocial function, physical features, and other health status all potentially may contribute to differences in the prevalence of back pain in the population. Controlling for all of these variables to compare different epidemiologic studies is unrealistic. Despite the varying prevalence rates, many studies show that low back pain is a common and frequent problem in the general adult population.

The prevalence rates reported for low back pain in the population vary widely. It is estimated that 15% to 20% of adults experience back pain during a single year and 50% to 80% experience at least one episode of back pain during an individual lifetime [1,12,13]. A systematic review of studies in the literature evaluating the prevalence of low back pain between 1966 and 1998 notes that the methods of data collection, sample sizes, response

rates, and prevalence time frames varied widely, even when strict methodologic criteria were used to include only high-quality studies [14]. In this evidence-based review, the ranges for prevalence rates reported were 12% to 30% for point prevalence studies, 22% to 65% for 1-year prevalence studies, and 11% to 84% for lifetime prevalence studies [14]. In a similar methodologic literature review during a shorter but similar time period, Loney and Stratford [15] reported the point prevalence rates for any duration of low back pain at the time of the surveys to be 4% to 33%, whereas the point prevalence rates for low back pain lasting greater than 2 weeks were lower.

Prevalence of neck pain

There are fewer population-based epidemiologic studies on neck pain. It is estimated that one fifth of the adult population experiences neck pain over a 1-year period and two thirds experience neck pain at least once during their lifetime [16,17]. Other community-based studies report 6-month prevalence rates for neck pain of approximately 40% in the working population [18,19]. Approximately 18% of the general population visits a health care professional annually for neck pain and approximately 5% of patients who have neck pain report significant disability from the pain [16,20]. Disability from neck pain seems less common than for back pain but still can be a significant burden in the population. The prevalence of neck pain increases with age and is more common in women than men [21].

Prevalence in different age groups

Children and adolescents

Most epidemiologic studies of spine pain have focused on adults and working populations, and back pain in the childhood or adolescent period has been investigated in less detail. Although generally it is believed that back pain is uncommon in children and adolescents, several studies have attempted to estimate the prevalence in this population and to determine if the presence of pain at a young age predicts the presence in adulthood [22]. The prevalence of low back pain in younger individuals is variable. In a study of adolescents between ages 11 and 15, 11% to 50% self-reported experiencing pain in their back [23]. The age of onset of back pain in children is approximately 13 to 14 years, after which the prevalence rates may increase and become similar to the adult prevalence rates in the older adolescent population [22–24]. Although the evidence is conflicting, genetic predisposition, socioeconomic status, athletic activities, the presence of scoliosis, and increased height are factors suggested to increase the risk for back pain in children [22,25].

Neck pain also is a problem in the adolescent age group, with 15% to 30% experiencing neck pain [26,27]. Symptoms in adolescence are shown to predict morbidity from neck pain in adulthood [26].

Elderly

Despite the growing elderly population, few epidemiologic studies have focused on the presence of back pain in the older population. In a survey of adults age 65 years or older, however, back pain was considered to be one of the most important factors to affect individual state of health [28]. Back and neck pain is a common problem in the older population, and the prevalence of low back pain in the older population (>65 years) may be higher than in younger adults. Several studies show that approximately one fifth of visits to physicians for back problems occur in patients more than 65 years old [29,30].

Bressler and colleagues [31] systematically reviewed the literature between 1966 and 1999 for studies assessing low back pain in patients older than 65 years and found the prevalence in the general community to be 13% to 49%. In older patients evaluated in a medical practice setting, the prevalence was slightly higher, at 23% to 51%. In a study of individuals ages 70 to102, the 1-month prevalence rate of back pain was 25% [32]. Other studies report similar findings, with "frequent" back pain over a 1-year period occurring in approximately one third of the older population [33]. Back pain consistently is shown to be more frequent in older women than men [32,33]. The prevalence of back pain decreases significantly in women over age 85 and men over age 90 [33,34]. The reason for this decline in the oldest patients may be related to recall bias, the acceptance of some pain as "natural," less reporting of their pain, or a lesser degree of physical activity. Despite a high prevalence of back pain in the elderly, most patients experience only intermittent or episodic pain rather than constant or progressive pain [35]. In one survey of patients between ages 68 and 100, however, 22% of responders indicated that they experienced back pain "on most days" [34]. Nonetheless, functional limitation was reported in approximately only 7% of older patients who had back pain, and most patients were not impaired significantly by the pain [33].

The frequency of neck pain decreases after age 50 [19]. The prevalence of neck pain in older patients (>70 years) is slightly less than low back pain in one population-based study, with a reported 1-month prevalence of 11% for neck pain compared with 15% for low back pain [35]. The likelihood of experiencing neck and low back pain together, however, is high in older individuals [35]. Although the prevalence of low back pain is shown to be higher in older women than men, no gender differences are found with respect to the prevalence of neck pain [31,35].

The studies that evaluate the frequency of back and neck pain in the elderly may underestimate the true prevalence rates for several reasons. Factors that may lead to underreporting in this age group include the presence of cognitive impairment, depression, and decreased pain perception. In addition, elderly patients may have an attitude of not wishing to burden their caregivers and, therefore, may not complain of pain [31].

Course of low back and neck pain

The course of back and neck back pain refers to the progression, stabilization, or resolution of pain after the initial onset and diagnosis. Similar to the difficulty in determining the prevalence, defining the typical clinical course of pain in the population is challenging. Differences in the terminology used to define the course of pain, etiologies, treatments, and outcome parameters confound comparison of prognostic studies. For example, in some studies, a good outcome may be considered when patients no longer seek medical attention or return to work, even though the pain may persist, whereas others define a good outcome based on complete resolution of pain.

It generally is believed that most episodes of low back pain are self-limiting. It is estimated that approximately 50% of patients who have acute low back pain no longer are disabled after 2 weeks and 70% recover by 1 month. Furthermore, nearly 90% of patients recover from an acute episode of pain by 3 months, leaving only 10% of patients who continue to seek medical care after 3 months [1,36]. With respect to the prevalence of episodes of pain lasting various durations, the 1-year prevalence of pain lasting longer than 2 weeks is 15% and pain lasting 3 to 6 months occurs in only 5% to 10% of patients who have back pain [12].

Several studies have attempted to determine the course of back pain, with similar reported rates of recovery and progression to chronic pain. In one study of 530 patients who had low back pain of varying degrees of severity, resolution of the pain was reported in 27% during a 1-year period [8]. Another review of the prevalence studies in the literature that assessed the course of back pain found that between 42% and 75% of subjects continued to experience pain 1 year after onset and between 44% and 78% of subjects experienced relapses of pain [13]. Another study followed adults who experienced an episode of back pain lasting less than 2 weeks for 12 months, measuring predominantly days absent from work and the degree of complete recovery of pain, and found that 45% of patients continued to complain of low back pain at the 1-year follow-up, although 50% returned to work within 8 days after evaluation [37]. Although these finding may be interpreted as indicating that back pain resolves completely within 3 months in most patients, alternatively they may indicate only that patients continue to experience pain but simply do not require further medical attention.

The findings in the literature support the concept that recurrent episodes of back pain are common and having experienced a prior episode of low back pain consistently is a strong predictor of future episodes [3,6,7]. In many instances, new or first-time episodes often develop into longer and possibly more disabling episodes over time and eventually into chronic back pain. The definition of chronic back pain is variable but typically refers to pain persisting beyond 3 months. Much research has been undertaken to determine the prevalence of chronic back pain and variable rates are reported. One study finds that 79% of patients who have a new episode of

back pain experience chronic pain, with many experiencing pain lasting more than 1 year in duration [36]. In a longitudinal study of patients in the United Kingdom, 20% of patients who did not experience chronic pain when surveyed in 1996 experienced chronic back pain when surveyed 4 years later [38]. In the initial survey, however, nearly 60% of patients experienced pain somewhere other than in their back, suggesting that previous chronic pain or poorer general health is predictive of the development of chronic back pain [38]. Other studies also find that the point prevalence rates of low back pain is higher in patients who have experienced previous episodes of low back pain compared with those who do not have a history of low back pain.

Several other predictors for the transition from acute to chronic back pain are proposed, including the initial duration of the first episode of back pain and the severity of pain. The risk for developing chronic disability from back pain becomes higher when the duration of the initial episode of back pain exceeds 14 days [39]. The longer the initial episode of back pain lasts, the less likely that patients return to work; fewer than 50% of patients return to work after experiencing back pain lasting longer than 6 months [40]. Patients who have a prior history of absenteeism from work because of an episode of back pain, older age, or a prior history of low back pain likely have a poorer outcome after a single episode of pain and more likely have persistent or chronic low back pain after an initial episode [37,41]. Patients who have more severe baseline pain are less likely to experience resolution compared with those who have mild baseline pain (10% versus 36% with resolution) [39]. Other studies suggest that women are more likely to experience ''persistent'' chronic back pain than men, but age had no effect on the development of chronic pain [38].

The course of neck pain has been evaluated less frequently than that of low back pain. A 1-year prevalence rate of 11% is reported for neck pain last more than 1 month. Persistent pain at 6 to 12 months after an episode of neck pain has been reported in 10% to 37% of individuals, and in one survey approximately half of the patients who experienced pain at one point in time continued to experience pain at a 1-year follow-up [42–45]. Recurrent episodes of neck pain are common and occur in approximately one quarter of individuals [44]. These findings indicate that the course of neck pain often is one of periods of remission and exacerbation rather than one of complete resolution.

Risk factors for back pain

Despite the variability in the prevalence rates reported for back and neck pain in the general population, it is evident that spine pain is a common and significant medical condition with a tremendous social and economic impact on society. Back pain is a leading cause of absenteeism from work,

temporary disability, and workers' compensation; therefore, the financial costs to society are enormous. Identifying factors that may increase the risk for or predispose individuals to the development of back pain is critical in attempting to reduce the prevalence and ultimately the social impact of this problem.

Many studies have attempted to identify and evaluate the contribution of multiple different demographic, physical, socioeconomic, psychologic, and occupational factors to the development of spine pain. There is a significant limitation in interpreting the literature on risk factors, because many of the studies rely on self-reported parameters and on statistical correlations of association among large cohorts of the population. Many factors are implicated in the predisposition to the development of pain. One review notes that more than 55 different individual factors and 24 work-related factors have been studied in relation to back pain [46]. Most of these factors, however, are assessed only in single or small studies, with weak and nonreproducible evidence to support a definite association. Several risk factors are evaluated more thoroughly and the results of these risk factors are discussed in more detail (Box 1) [5,11]. Although not studied in as much detail as back pain, similar risk factors for neck pain are identified [21].

Box 1. Risk factors for back pain

Demographic factors
Age
Gender
Socioeconomic status and education level

Health factors
Body mass index (BMI)
Tobacco use
Perceived general health status

Occupational factors
Physical activity, such as bending, lifting, or twisting
Monotonous tasks
Job dissatisfaction

Psychologic factors
Depression

Spinal anatomy factors
Anatomic variations
Imaging abnormalities

Demographic factors

Age

The prevalence of back pain in different age groups is discussed earlier in this article. The highest rates of back pain consistently are found in the adult population from the third to the sixth decades, with those experiencing new onset of back pain more likely to be in the third decade [5,7,11,47]. A systematic review of the literature comparing the prevalence of low back pain in different age groups finds lower prevalence rates in younger adult patients (ages 20–35) with rates increasing with age until ages 60 to 65, after which there is a decline in the frequency of pain [12,15]. Older patients more likely experience persistent or intermittent neck and low back rather than new onset of pain than younger individuals [7,45]. As noted previously, the presence of low back pain in adolescence seems to be a risk factor for the development of low back pain in adulthood [48].

The causal relationship between age and the development of back pain is not entirely clear. The high prevalence of back pain in younger adults may be related to the fact that the younger population is more physically active in general than older population and the activity may predispose them to developing pain (discussed later) or the effect of back pain on their daily lifestyle may be more pronounced and, therefore, cause them to seek medical attention more often. With increasing age, more stress and anatomic changes in the spinal structures also could result in a predisposition for experiencing more chronic and persistent pain.

Gender

Back and neck pain poses a significant problem for men and women. Although several studies suggest that women are more predisposed to experiencing back pain than men, the literature does not consistently identify significant differences in the incidences between genders [11,49]. In the older age population, women have a higher prevalence of low back pain than men, possibly related to a higher risk for osteoporosis involving the spine [31]. Several reports indicate that women are more likely than men to use health care for back pain, take more sick days from work, have a poor outcome after a single episode of low back pain, and develop persistent, chronic pain lasting more than 3 months [38,41,49].

Neck pain is reported more frequently in women than in men, and women are more likely to seek medical attention from a health care professional [19]. Chronic or persistent neck pain over a 1-year period is reported with similar frequency in men and women [45].

Socioeconomic status and level of education

Low socioeconomic status and a lower level of education are associated with disability retirement from back pain [50–52]. In a systematic review of the literature, Dionne and colleagues [51] found a consistent association of

increased prevalence of back pain with low educational status. There seemed to be a stronger effect, however, of education on the duration and recurrence of back pain than on the onset of pain. Furthermore, the course of back pain was less favorable in those who had low educational status, with a poorer outcome in those patients. The incidence of disability retirement from back pain was seven- to tenfold higher in unskilled workers compared with skilled workers in a higher social class [50]. Similarly, the incidence of disability increased by 22- to 25-fold in patients who had less than or equal to 7 years of education compared with those who had college degrees. In addition, patients who had a low level of education demonstrated more misconceptions about low back pain and endorsed pain beliefs associated with poorer ability to adjust to chronic pain [52].

There are several proposed mechanisms that may account for the relationship between low educational status and back pain. There is a direct relationship between education and socioeconomic status, because the amount of formal education contributes to the types of jobs individuals may secure and, subsequently, the types of jobs influence their socioeconomic status. The association between socioeconomic status and the development of back pain disability is not understood completely, although a correlation between socioeconomic status and other environmental factors, such as cigarette smoking, obesity, chronic stressful events, dietary habits, and physical occupations may play a role.

Health factors

Obesity

Obesity or high BMI (>30 BMI) is an independent predictor of the development of low back pain and disability from pain [1,53,54]. The association of BMI on the development of back pain may be stronger in women than men [55]. Vogt and colleagues [53] reviewed the prevalence and risk factors in postmenopausal women who had back pain and found that postmenopausal women who had low back pain had a higher BMI and weighed approximately 2 to 3 kg more than those who did not have back pain.

Smoking

Smoking is suggested as a risk factor for the development of back pain, although the supportive evidence for this association is modest at best. Smoking has an impact on the musculoskeletal system by several mechanisms, including increasing the risk for osteoporosis and fractures, decreasing bone density, and increasing degenerative changes in the spine. Several studies identify a higher prevalence of back pain in smokers compared with nonsmokers [56–60]. For example, one study finds that individuals who began smoking at age 16 and continued to smoke moderately or heavily for 17 years had a 90% higher relative risk for back pain at age 33 than

nonsmokers [60]. In another study, smoking for more than 15 years is associated with a higher risk for sciatic pain, but volume of smoking is not a contributing factor, whereas another study finds that smoking volume and duration were associated with chronic back pain [61,62]. Because most studies do not control for other possible associated variables, the evidence for a clear causal link between back pain and smoking is not strong. An indirect stressor effect related to chronic coughing in smokers also is proposed to account for the possible association with back pain [55]. In contrast, other studies show that smoking is not associated with a significantly increased risk for back pain [9,11,55]. It remains unclear whether or not smoking is a definite risk factor for developing pain.

Health status

Self-rated health status is an important predictor of the development of back pain in men and women [3,11,35,55,63]. Patients who have a perception of poorer health are more prone to back pain [11,41,55,63]. In one prospective, longitudinal study of back pain in Canadian adults, the strongest risk factor for the development of back pain was a self-rated poor overall health status [11]. Croft and colleagues [55] studied a large population that had low back pain in the United Kingdom and also found that poor general health at baseline was the strongest predictor of a new episode of back pain.

Patients who have back pain experience many co-occurring health problems and comorbidities, including bone and joint diseases, migraine headaches, pulmonary diseases, cardiac diseases, and gastrointestinal diseases [32]. The relationship between these comorbidities and back pain is unclear, but this association may account for the self-reported poor health status found in individuals experiencing back pain. Therefore, in the studies that demonstrate a relationship between the perception of poor health and back pain, it is likely that the presence of back pain is one of many factors that lead to the perception of poor health status rather than a direct causal relationship.

Occupational factors

Occupational and leisurely physical activity

Repetitive physical activities may produce cumulative stress on the spine and lead to the development of back pain. Athletic activities or repetitive physical maneuvers that occur with manual labor occupations are suggested to predispose individuals to back pain [1,64]. It is estimated that 37% of low back pain worldwide is attributable to occupational risk factors [65]. A systematic review of the literature to assess the evidence related to the type of physical activity on the development of back pain concludes that there is moderate evidence to support a relationship between heavy physical work and manual handling techniques and pain but no evidence for an association with prolonged standing or sitting [64]. The type, degree, and duration of

physical activity that individuals perform on a regular basis may affect the development of back pain; however, studies assessing the level of physical activity as a predictor of back pain report conflicting results.

The types of physical activity performed, from occupational and recreational standpoints, potentially may play a role in the development of neck and low back pain. Occupations that consist of manual material handling, such as heavy lifting, moving, carrying, bending, or twisting; those that include long-term static positions, such as sitting; and those that have high exposure to low-frequency whole-body vibration are perceived to apply more stress on the structures in the spine and are a risk factor for back pain [1,64]. Similarly, work-related risk factors for the development of neck pain include neck flexion, arm posture, sitting for more than 95% of the working time, twisting or bending of the trunk, and hand-arm vibration [66,67]. Professions, such as those in sales, clerical work, repair, service, and transportation, more likely are associated with back pain than other professional occupations [5]. Several types of occupations are stratified according to level of risk for stress on the back; those that are at a low risk include managers, professionals, and clerical or sales workers, whereas higher-risk professions include operators, service workers, and farmers [65]. The degree of acute physical load applied to the back and the cumulative or long-term load to the back may play a role in the development of pain [64]. Adults whose job requires standing or walking for more than 2 hours per shift and women who lift or move more than 25 pounds are more than twice as likely to consult a general practitioner for back pain than those whose jobs are more sedentary and do not require lifting [68].

Another risk factor identified as predicting the progression from acute to chronic occupational back pain is the need to lift for at least 75% of the work day [69]. In workers returning to their occupation after experiencing an episode of back pain, those who were unable to return with light duties on return to work and those who were required to lift for most of the day were at a higher risk for developing chronic pain [69].

In some cases, the perception of the degree of physical demand, rather than the actual degree of activity, may be associated with pain. In one survey of 715 patients who were granted back pain disability, the strongest predictor for developing back pain disability was the patients' perception that their work was ''physically demanding'' [63]. Subjects who reported physically demanding work frequently were at higher risk for disability than those who reported infrequent physically demanding work.

Several studies have surveyed athletes in various types of sporting activities to assess the prevalence of back pain, with conflicting results [64]. When assessed according to specific sports, no increased risk for back pain was seen in golf, cycling, or athletic training [64]. In a study of cross-country skiers and rowers, the 1-year prevalence of self-reported low back pain was higher than in nonathletic controls [70]. Back pain appeared more often during periods of training and competition.

In contrast to the evidence suggesting that physical stress may lead to the development of back pain, other studies report that a lower level of physical activity is associated with an increased risk for back pain [32]. In one study, a lower baseline level of sporting activities is associated with a higher likelihood of experiencing back pain episodes [9]. In a another study, however, of a cohort of adults in the general population evaluating the association of low back pain and self-reported level of physical activity compared with their peers, the perceived level of leisurely physical activity in the subjects who had back pain was not significantly different than those who did not have pain [55]. The causative nature of a lower physical activity level and back pain is unclear, and the presence of back pain may be the cause of limitation of physical function rather that a result.

Job satisfaction

Studies also have attempted to assess the role of work satisfaction with the development of back pain. Although some studies suggest that workplace dissatisfaction is a predictor of back pain, others show that level of work satisfaction is not associated with an increased risk for back pain [9,69,71]. In a study of a large population of aircraft employees, the degree of work satisfaction was associated significantly with back pain, with subjects who had low work satisfaction 2.5 times more likely to report a back injury than those who had high job satisfaction [72].

The psychologic work environment also is associated with the experience of neck and shoulder pain [67]. Secretaries who reported a ''poor'' psychologic work environment with poor social support at work were found to have a higher relative risk for experiencing frequent neck pain compared with those who reported a ''good'' work environment [73].

Psychologic factors: depression

There is a strong association between back and neck pain and depression [10,74–78]. The experience of pain involves a complex interaction of physical, emotional, cognitive, and behavioral components. The ability to cope with pain relies on emotional and psychologic capabilities, and underlying depression may affect the mechanism of coping adversely, thereby leading to an increased perception or experience of pain. Patients who experience pain, particularly when the precise cause cannot be determined, often feel hopeless and helpless. The inability to obtain timely or effective relief for the pain may result further in depression and anxiety. In the acute phase of back pain, a natural emotional reaction, such as anxiety or worry about the cause of the pain, may occur. As the pain persists, increasing behavioral or psychologic reactions may develop, including anger, depression, and somatization. Psychologic changes and depression become more prominent as back pain becomes more chronic. In individuals who have chronic pain, a complex interaction between the physical, psychologic, and social

environments may develop and patients may adopt a ''sick role,'' where interaction with their environment, social obligations, and normal responsibilities become more difficult [79]. Patients who have chronic back pain are approximately 6 times more likely to be depressed than pain-free individuals [78]. A genetic predisposition to symptoms of back pain and to depression or anxiety also is suggested as playing a role [80].

In 2000, Linton [77] systematically reviewed the literature related to the interaction between psychologic factors and the development of back or neck pain and came to several conclusions. First, a significant relationship between stress, distress, anxiety, mood, and depression and neck and back pain was identified consistently. Second, this relationship existed independently of other variables. Third, psychosocial variables have more impact than biomedical factors on back pain disability and are linked to the transition from acute to chronic pain disability. In addition, cognitive factors, such as attitude, passive coping, and fear-avoidance beliefs, also were related to the development of pain and disability.

Depression, as identified by patient report, also is a predictor of developing low back pain rather than a response to the experience of pain. Several studies demonstrate that depression is an independent risk factor for the development of back or neck pain and those individuals who have self-reported depression are twice as likely to develop back pain [10,81]. The degree of pain may correlate with the development of depression, and individuals who have more severe pain have a higher likelihood of depression [78].

Spinal anatomy factors

Several anatomic factors can affect the spine, including congenital abnormalities, degenerative changes, scoliosis, osteoporosis, and disk herniations. Congenital vertebral abnormalities, such as a transitional vertebra or spina bifida occulta, may be contributors to back pain. The presence of a transitional lumbosacral vertebra refers to a total or partial fusion of the transverse process of the lowest lumbar vertebra to the sacrum. A review of approximately 800 radiographs from male patients who had a 4-week or more history of low back pain found congenital vertebral abnormalities in 10%, with approximately half being transitional vertebrae and half spina bifida occulta [82]. Transitional vertebrae are found in approximately 8% to 30% of young and middle-aged men. The evidence regarding the association between a transitional vertebrae and the development of low back pain is conflicting [83–86]. In several studies, a transitional vertebra is shown to be the cause of back pain [83–85]. Increased prevalence of disk protrusion or extrusion above the transitional vertebra or altered biomechanics associated with asymmetric transitional vertebrae may account for the pain. Other studies find no association between the presence of a transitional vertebra and any type of low back pain [86].

The association between disk abnormalities on imaging studies and back pain is the subject of controversy. Disk disruption is found in approximately 40% of a population with low back pain [87]. Several studies conclude, however, that the presence of lumbar disk abnormalities often is seen in asymptomatic subjects and does not predict the development of low back pain [88–90]. In an assessment of 148 asymptomatic VA outpatients followed over a 3-year period, the incidence of low back pain was 67%, and no significant association was found between the development of low back pain and MRI findings, including endplate changes, disk degeneration, annular tears, or facet degeneration [10]. Another study finds disk degeneration on MRI in 39% of working males, between ages 20 and 58, with a higher frequency of disk degeneration in the older patients, but failed to find an association between lumbar disk degeneration on MRI and the presence of low back pain [91]. The findings of disk extrusion (but not protrusion) or central spinal stenosis more likely are associated with the development of pain [10].

In a study evaluating the association between radiographic cervical spine degenerative changes and neck pain or disability, no significant differences were found in the degree of pain between patients who did or did not have radiographic cervical spine degeneration [92].

Summary

Low back and neck pain remains a common problem and one of enormous social, psychologic, and economic burden. Low back pain afflicts individuals of all ages, from adolescent to elderly populations, and is a major cause of disability in the adult working population. The risk factors for the development of spine pain are multidimensional, with physical attributes, socioeconomic status, general medical health and psychologic state, and occupational environmental factors all playing a role in contributing to the risk for experiencing pain.

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