International Association for the Study of Pain®

Technical Corner from *IASP Newsletter*
July/August 1996

This section, edited by Charles B. Berde, MD, PhD presents
timely topics in pain research and treatment.

Influence of Weather on Report of Pain

Robert N. Jamison, PhD

Departments of Anesthesia and Psychiatry,
Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, USA

The perceived relationship between changes in weather and pain has been recorded since the classical Roman age. Hippocrates was the first to note, in about 400 b.c., that many illnesses were related to changes in season (Rosen 1979). The large body of folklore about how weather affects pain is reflected by traditional sayings and expressions, such as "aches and pain, coming rains," "feeling under the weather," and "ill health due to evil winds." Monica Seles, who recently recovered after being stabbed in the back during a tennis tournament, reported in an interview published in *Sports Illustrated* (July 17, 1995) that weather changes influenced the site of her scar. When asked if she had any residual pain from her injury, she stated that "the scar tingles only when rain is coming."

The various meteorologic factors that have been suspected of contributing to changes in pain include temperature, barometric pressure, precipitation, humidity, thunderstorms, sunshine, and increased ionization of the air (Rosen 1979; Harlfinger 1991; Sulman et al. 1970). Certain pain diagnoses have been reported to be especially sensitive to weather changes, including rheumatoid arthritis (Patberg et al. 1985; Affleck et al. 1987; Hill 1972; Sibley 1985; Rasker et al. 1986; Guedj and Weinberger 1990), osteoarthritis (Laborde et al. 1986), fibromyalgia (Yunus et al. 1981), phantom limb pain (Harlfinger 1991), headaches (Anderson et al. 1965; Brown 1977), scar pain (Weinbrecth and Simon 1989), gout (Katz and Weiner 1975), trigeminal neuralgia (Kranzl 1977), low back pain (Menges 1983; Hendler et al. 1995), and pain influenced by mood disorder (Romano and Turner 1985; Persinger 1980). Data on the relationship between climatologic changes and pain are conflicting (Slovis et al. 1986; Redwood et al. 1976). Despite the frequency with which such a relationship is reported, few controlled studies have been designed to investigate this issue, and many questions remain unanswered. This article reviews the current literature on the effects of weather on report of pain.

Case Reports

The first publication of documented changes in pain perception associated with the weather was in the *American Journal of Medical Sciences* in 1887. This case report described a person with phantom limb pain who concluded that "approaching storms, dropping barometric pressure and rain were associated with increased pain complaint" (Shutty et al. 1992). Most investigations examining the relationship between weather and pain have studied persons diagnosed with arthritis. After reviewing many case reports, Rentshler reported in *JAMA* in 1929 that there was strong evidence that "warm weather is beneficial and barometric pressure changes are detrimental to patients with arthritis" (Shutty et al. 1992). Since then many other studies have concluded that cold weather and changes in barometric pressure contribute to increased pain in persons diagnosed with arthritis (Hill 1972; Patberg et al. 1985; Rasker et al. 1986), although some exceptions have been noted (van de Laar et al. 1991).

Surveys and Experimental Studies

Yunus et al. (1981) reported that 92% (N = 50) of fibromyalgia patients believed that "cold and humid" weather negatively influenced their pain symptoms. Hill (1972) estimated that between 80% and 90% of patients diagnosed with arthritis report weather sensitivity. Sulman et al. (1984) studied patients during periods of dry heat and intervals of cold rain and wind. They concluded that malaise, inactivity, depression, and psychological discomfort reported during the cold rainy period correlated well with changes in serotonin, thyroxine, steroid, and amine metabolism. Weinbrecth and Simon (1989) found a correlation of the number of hospital admissions with decreased temperature and increased humidity in patients with lumbar disk prolapses. Unfortunately, these studies were descriptive investigations which relied mostly on reported estimates and correlational findings.

Guedj and Weinberger (1990) attempted to correlate pain and activity levels with changes in weather by diagnosis. They instructed 16 patients with rheumatoid arthritis, 24 with osteo-arthritis, 11 with inflammatory arthritis, and 11 with fibromyalgia joint pain to monitor their pain and activity every day for four weeks. They found that patients whose pain was attributable to rheumatoid arthritis, osteoarthritis, or fibromyalgia were all adversely affected by changes in barometric pressure. Patients diagnosed with rheumatoid arthritis or osteoarthritis also experienced increased pain with changes in temperature. For those diagnosed with inflammatory arthritis, no relationship between weather variables and pain was apparent.

Jamison and Parris (1990) correlated the hourly pain ratings of 340 chronic pain patients with concurrent national weather statistics in their area of residence. The patients were asked to monitor their pain on an hourly basis for one week. The results showed the highest correlation of weather with headaches and upper extremity pain. Hendler et al. (1995) examined the relationship between diagnostic data on 97 chronic pain patients and the perceived effect of weather on their pain. Patients with back pain reported the most sensitivity to weather changes, while persons with diffuse myofascial and temporomandibular joint pain reported the least.

Shutty et al. (1992) asked 70 chronic pain patients to complete a weather and pain questionnaire assessing sensitivity to meteorologic variables of temperature, sudden changes, humidity, precipitation, thunderstorms, and sunshine. The authors correlated weather sensitivity with pain intensity, the interference of pain with activities, physical symptoms, duration of pain, and scores on the SCL-90, which is a checklist of emotional distress. The patients consistently identified the meteorologic variables that influenced their pain, but they were not consistent in reporting which physical symptoms were most affected by the weather variables. Temperature and humidity had the greatest impact on the pain of these patients, affecting 87% and 77%, respectively. Patients who were weather-sensitive and those who were not were similar in terms of demographic factors and emotional distress. The authors concluded that patients who were weather-sensitive reported significantly greater pain intensity, greater chronicity of pain problems, and greater sleep disturbances than those who were not weather-sensitive.

Hagglund et al. (1994) used the same weather questionnaire used by Shutty et al. (1992) to investigate the relationship between weather sensitivity and disease severity in 84 persons diagnosed with fibromyalgia. Eighty-eight percent of the participants believed that precipitation and changes in temperature exacerbated their pain. Those with greater weather sensitivity reported greater functional impairment and psychological distress.

Jamison et al. (1995) investigated differences in perceived influence of weather on pain among 557 chronic pain patients living in four U.S. cities: San Diego, California; Nashville, Tennessee; Worcester, Massachusetts; and Boston, Massachusetts. Correlation of demographic and weather variables with questionnaire data showed that the majority of patients (67.9%) believed that change in weather affected their pain. Cold and damp had the greatest influence (60.7% and 72.8%, respectively). Many patients reported that their pain was affected before (52.6%) and during (62.3%) rather than after weather changes. Younger patients with arthritis reported greatest sensitivity to changes in weather. Surprisingly, weather sensitivity was unrelated to all other demographic variables or to geographic region. Thus, perceived effect of weather on pain was not found to be related to local climate.

Few well-designed experimental studies have examined the effects of weather changes on pain. Hollander (1961) attempted to manipulate barometric pressure and humidity in a climate-controlled room devised in his laboratories. Arthritic patients reported more pain with the combination of increased humidity and decreased barometric pressure but no change in pain when only one weather condition was changed. Although often cited, this study has been criticized because of the small number of subjects (N = 12) and the short time that the subjects were in the chamber

Possible Mechanisms

Various explanations have been given to account for the effects of weather changes on pain (Jamison et al. 1995; Latman and Levi 1980). Certain physiologic factors associated with changes in weather seem to impact persons with chronic pain. Because tendons, muscles, bones, and scar tissue are of various densities, cold and damp may expand or contract them in different ways. Sites of microtrauma may also be sensitive to expansions and contractions due to atmospheric changes. Changes in barometric pressure and temperature may increase stiffness in the joints and trigger subtle movements that heighten a nociceptive response. Such alteration of structure may be particularly problematic in inflammatory joints whose sensitized nociceptors are affected by movement (Rasker et al. 1986; Besson and Chaouch 1987). Change in barometric pressure may also cause a transient "disequilibrium" in body pressure that may sensitize nerve endings and account for increased pain preceding changes in temperature or humidity. Finally, seasonal weather patterns influence mood in some persons (Sulman 1984; Romano and Turner 1985) and thereby indirectly affect pain perception. Although weather sensitivity seems to be a multifactorial phenomenon, the results of most studies suggest that exploring a physiologic basis for weather-oriented changes in pain perception in persons with chronic pain may be fruitful.

The common belief that pain is improved by living in a better climate is not supported by the current literature, perhaps because the body establishes an equilibrium to the local climate so that relative changes in weather trigger an increase in pain regardless of the actual weather. Pain patients living in a mild climate report sensitivity to seasonal changes. Pain duration, pain intensity, pain frequency, history of surgery, or pain site do not account for effect of climatologic changes on pain. Differences in these factors between weather-sensitive and non-weather-sensitive patients are not consistent or useful in predicting group classification. Thus, local climate has little influence on how patients perceive the effect of weather on their pain.

Conclusions

There is much anecdotal but little empirical evidence for the effect of weather changes on pain. Much of the literature consists of either case studies or experimental investigations with few subjects and a reliance on self-report measures. Laboratory studies to determine the exact mechanism of action have been largely unsuccessful. Nonetheless, the mere frequency of report suggests a significant relationship between weather changes and pain intensity. This neglected topic deserves attention by both basic scientists and clinical researchers

References

Affleck G, Pfeiffer C, Tennen H, Fifield J. Attributional processes in rheumatoid arthritis patients. Arthritis Rhem 1987; 30:927–931.
Anderson B, Heyman A, Whalen RE, Saltzman H A. Migraine-like phenomena after decompression from hyperbaric environment. Neurology 1965; 15:1035–1040.
Besson JM, Chaouch H. Peripheral and spinal mechanisms of pain. Phys Rev 1987; 67:67–184.
Brown BB. Stress and the Art of Biofeedback. New York: Bantam Books, 1977.
Guedj D, Weinberger, A. Effect of weather conditions on rheumatic patients. Ann Rhem Dis 1990; 49:158–159.
Hagglund KJ, Deuser WE, Buckelew SP, Hewett J, Kay DR. Weather, beliefs about weather, and disease severity among patients with fibromyalgia. Arthritis Care Res 1994; 130–135.
Harlfinger O. [Weather-induced effects on pain perception.] Fortschr Med 1991; 109:647–650.
Hendler NH, Jamison RN, Morrison CH, Piper JK, Kahn, Z. The relationship of diagnoses and weather sensitivity in chronic pain patients. Neuromuscul Sys 1995; 3:10–15.

Hill DF. Climate and arthritis in arthritis and allied conditions. In: Hollander JL, McCarthy DC (Eds), A Textbook of Rheumatology, 8th ed., Philadelphia: Lea and Febinger, 1972, pp 256–263.
Hollander JL. The controlled-climate chamber for study of the effects of meteorological changes on human diseases. Trans NY Acad Sci 1961; 24:167–172.
Jamison RN, Parris WCV. Weather patterns affect chronic pain: myth or reality? Pain 1990; 5(Suppl.):S292.
Jamison RN, Anderson KO, Slater MA. Weather changes and pain: perceived influence of local climate on pain complaint in chronic pain patients. Pain 1995; 61:309–315.
Katz JL, Weiner H. Psychobiological variables in the onset and recurrence of gouty arthritis: a chronic disease model. J Chronic Dis 1975; 28:51–62.
Kranzl B. [Trigeminal neuralgia: effect of external and internal influences on the disease as well as studies on infiltration treatment of pain.] Osterr Z Stomatol 1977; 74:246–261.
Laborde JM, Dando WA, Powers MJ. Influence of weather on osteoarthritics, Soc Sci Med, 1986; 23:549–554.
Latman N, Levi LN. Rheumatoid arthritis and climate. N Engl J Med 1980; 303:1178.
Menges LJ. Chronic low back pain: a medical-psychological report. Soc Sci Med 1983; 17:747–753.
Patberg WR. Effect of temperature and humidity on daily pain score in a patient with rheumatoid arthritis. Arthr Rheum 1989; 32:1627–1629.
Patberg WR, Nienhuis RLF, Veringa F. Relation between meteorological factorsand pain in rheumatoid arthritis in a marine climate. J Rheumatol 1985; 12:711–715.
Persinger MA. The Weather Matrix and Human Behavior. New York: Praeger, 1980.
Rasker JJ, Peters HJG, Boon DL. Influence of weather on stiffness and force in patients with rheumatoid arthritis. Scand J Rheumatol 1986; 15:27–36.
Redwood AM, Williams EM, Desal P, Serjeant GR. Climate and painful crisis of sickle-cell disease in Jamaica. Br Med J 1976; 1:66–68.
Romano JM, Turner JA. Chronic pain and depression: does the evidence support a relationship? Psychol Bull 1985; 97:18–34.
Rosen S. Weathering. NewYork: M. Evans, 1979.
Shutty MS, Cunduff G, DeGood DE. Pain complaint and the weather: weather sensitivity and symptom complaints in chronic pain patients. Pain 1992; 49:199–204.
Sibley JT. Weather and arthritis symptoms. J Rheumatol 1985; 12:707–710.
Slovis CM, Talley JD, Pitts RB. Nonrelationship of climatologic factors and pain sickle cell anemia crisis. J Chronic Dis 1986; 39:121–126.
Sulman FG. The impact of weather on human health. Rev Environ Health 1984; 4:83–119.
Sulman FG, Danon A, Pfeifer Y, Tal E, Weller CP. Urinalysis of patients suffering from climatic heat stress. Int J Biometeorol 1970; 14:45–53.
van de Laar MA, Bernelot Moens HJ, van der Stadt RJ, van der Korst JK. Assessment of inflammatory joint activity in rheumatoid arthritis in atmospheric conditions. Clin Rheumatol 1991; 10:426–433.
Weinbrecth WU, Simon F. [Effect of metorologic parameters on acute admission of patients with lumbar intervertebral disk displacement.] Z Orthop 1989; 127:650.
Yunus M, Masi AT, Calabro JJ, Miller KA, Feigenbaum SL. Primary fibromyalgia: clinical study of 50 patients with matched normal controls. Semin Arthritis Rheum 1981; 11:151–171.

advances in the medical sciences, the publisher recommends that independent verification of diagnoses and drug dosages should be made.