A Survey of Musculoskeletal Problems Encountered in High-Level Musicians

Paul H. Caldron, D.O., Leonard H. Calabrese, D.O., John D. Clough, M.D., Richard J. Lederman, M.D., Ph.D., George Williams, Ph.D., and Judith Leatherman, B.S.

The requirement of rapid controlled repetitive musculoskeletal activity by high-level musicians suggests that they may be a population at risk for a variety of occupational injuries. Yet, other than for pianists, little information exists in the medical literature. To evaluate the occurrence and variety of such problems, 250 high-level musicians completed a detailed questionnaire. It was found that 56.8% of the respondents reported musculoskeletal problems related to their profession, with 36.8% of the overall study group seeking medical care. The most common problems reported were tendinitis, muscle spasm, and nerve impingements. Loss of practice time and income due to injury was commonly reported. We submit that musicians commonly seek care for musculoskeletal problems that may result in the loss of professional income and practice time. Detailed studies of these injuries are needed to clarify pathogenesis, treatment, and prevention.

A wide range of occupationally related disorders has been studied. Such investigations have frequently led not only to better understanding of these problems but also to more accurate diagnosis, better treatment, and, most importantly, prevention. Examples of such successful efforts in recent years can be seen in the fields of sports medicine and dance medicine. Perhaps because musical performance has been traditionally viewed (mostly by nonmusicians) as non-exertional, studies of medical problems unique to musicians have been notably lacking. Our clinical experience with musically associated musculoskeletal problems, as well as information from a few isolated clinical reports, suggests that such ailments are not uncommon and are at times the source of significant disability measurable in loss of practice time, reduction in facility, and occasionally the premature curtailment of a career. Familiar examples of such disabilities include those of pianists Leon Fleischer and Gary Graffman.[1] Historically, the tragic end of Robert Schumann's performing years as a result of an injured hand serves as a dramatic reminder of the need for improvement in the approach to such instrumentally related afflictions.[2] In light of the paucity of data in this area, we initiated this pilot study to determine:

1. The nature and scope of occupationally related problems in musicians.
2. The extent of disability resulting from such injuries.
3. The frequency with which medical care was sought for managing such injuries.

Clinical experience with musically associated musculoskeletal problems suggests that such ailments are not uncommon and are at times the source of significant disability measurable in loss of practice time, reduction in facility, and occasionally the premature curtailment of a career.

Materials and Methods

Questionnaire

Members of the interdisciplinary section for the performing arts at the Cleveland Clinic Foundation designed a detailed questionnaire in order to elicit confidentially from musicians demographic data, specific information about playing experience, symptoms, specific injuries, and treatments rendered for all injuries believed related to playing an instrument.

Study Group

The questionnaire was distributed to 1245 musicians associated with various professional orchestras and musical teaching institutions in the northeastern Ohio area. Responses from the questionnaires were encoded and submitted for computer analysis. This report deals with evaluations of certain *non-wind instrument performers*, i.e., those who employ specific peripheral musculoskeletal functions to play the violin, cello, string bass, piano, organ, percussion/xylophone, harp, guitar, banjo, and dulcimer.

Statistical Analysis

Statistical analyses were performed by the Department of Biostatistics. Student's t-test was used to compare mean practice time lost and age differences between groups. Fisher's exact test was used to compare the groups on the basis of sex.

From the Department of Rheumatic and Immunologic Disease (Drs. Caldron, Calabrese and Clough), the Department of Neurology (Dr. Lederman), and the Department of Biostatistics (Dr. Williams and Ms. Leatherman), Cleveland Clinic Foundation, Cleveland, Ohio. Address correspondence to Leonard H. Calabrese, D.O., Department of Rheumatic and Immunologic Disease, Cleveland Clinic Foundation, 9500 Euclid Avenue, Cleveland, OH 44106-4775.

Presented in part at the American Rheumatism Association Scientific Meeting, Anaheim, California, June 1985.

Results

Of 1245 distributed, 378 completed questionnaires were returned (30.3% response rate), of which 250 were from non-wind instrumentalists. These musicians averaged 25 + 10 playing hours weekly and had a median of 12 years' playing experience. Fifty-eight percent described their primary role in music as students, 30% professional players, 11% teachers, and 1% amateur performers. Fifty-nine percent (147) reported musically-related musculoskeletal problems. The career length at the onset of problems affecting facility was a median of greater than eight years. The 250 non-wind instrumentalist respondents were subdivided for analysis and comparison on the following scale:

Group I—Those musicians reporting a musically related injury who sought care from a physician (N = 92)

Group II—Those musicians reporting a musically related injury who did not seek the care of a physician (N = 55)

Group III—Those musicians reporting *no* musically related injury (N = 103)

Comparisons between those reporting problems (groups I and II) with those reporting no problems (group III) revealed no significant differences with respect to age (17–73; mean 30). Females were more likely to report injuries and to seek medical care than males (P = 0.002).

The most commonly reported diagnoses were tendinitis, muscle spasm (inhibiting performance), and nerve entrapments (Table 1). Fingers, shoulders, and back led the list of symptom locations (Table 2). The most frequently reported problems by instrument category are displayed in Table 3; however, because the majority of respondents reported more than one isolated problem and location, we were unable to identify specific injury types or trends based upon instrument class. Overall, 36.8% of respondents sought medical attention for these problems. Percussionists, violinists/violists, pianists, and harpists reported injuries more frequently than bassists, cellists, organists, or guitarists (Table 3).

Stage chairs of improper or invariable height and inadequate stage lighting were frequently blamed for increased muscular tension, neck pain and backaches.

Musicians who sought medical care had missed more practice time than those who did not (mean 10.9 weeks [group I] vs. 2.2 weeks [group II] and 1.6 weeks [group III]); $p<0.001$. Thirty-four percent of musicians who experienced injuries reported some income loss. The impact of musculoskeletal complaints upon the facility of playing reported by musicians in groups I and II are categorized in Table 4, with loss of control of fine motions and power being the most common deficits. Three musicians reported having changed instruments, and four reported termination of their careers due to such problems. Nine musicians underwent surgery for musculoskeletal problems that they believed were caused or exacerbated by their playing. Among twenty-one female musicians who became pregnant during their playing careers, there were no reports of carpal tunnel syndrome; four reported fatigue or nausea that interfered with playing, one reported back pain, and two pianists reported difficulty reaching the keyboard.

Stage chairs of improper or invariable height and inadequate stage lighting were frequently blamed for increased muscular tension, neck pain and backaches. Performance anxiety and related autonomic symptoms were also linked by musicians to their musculoskeletal complaints.

Treatments for musculoskeletal problems in musicians most commonly included nonsteroidal anti-inflammatory drugs, muscle relaxants, analgesics, manipulations, and instruction in Alexander technique and Thiberge principles.

TABLE 1. **Musically-related Musculoskeletal Problems Reported by 250 Non-wind Instrumentalists**

Diagnosis	*No. of Musicians Reporting Diagnosis*
Tendinitis	70
Muscle spasm (inhibiting performance)	46
Nerve entrapments	32
Bursitis	23
Arthritis	23
Contractures	9
Atrophy	3
Other	27

TABLE 2. **Location of Symptoms Reported by Respondents***

Fingers	135	Neck	110
Thumb	97	Upper back	122
Hand	119	Mid back	88
Wrist	102	Lower back	122
Elbow	59	Legs	34
Shoulder	130		

*Numbers refer to total respondents who reported symptoms in these locations.

Discussion

Though several conclusions can be drawn from the present study, caution must be exercised in interpreting data obtained from such unsupervised questionnaires. Confidence in the accuracy of estimates of disease incidence and prevalence is low with less than a nearly 100% response rate. On the other hand, while little emphasis should be placed on reported nosologic diagnoses from such questionnaires, reliable information regarding symptoms and signs of disease as well as disability incurred and the nature of care sought can be readily obtained. With these reservations in mind, the following conclusions can be made:

1. Musculoskeletal disease apparently related to playing a musical instrument is relatively common.
2. Musically related musculoskeletal injuries lead not only to loss of practice and rehearsal time but frequently to loss of income.
3. The majority of musicians reporting musically related musculoskeletal injuries that result in loss of income are likely to seek formal medical help.

TABLE 3. **Most Frequent Problems Reported***

	1st Frequency	*N*	*2nd Frequency*	*N*	*3rd Frequency*	*N*
Violinists/ Violists	Blisters/ callouses	43	Sores	25	Tendinitis	23
Harpists	Blisters/ callouses	8	Tendinitis	5	Sores/spasms Nerve entrapment	2 2
Pianists	Tendinitis	31	Blisters	19	Spasm	14
Percussion	Blisters arthritis	3 3	Spasm Other	3 3	Sores Tendinitis	 1
Cellists	Blisters	13	Tendinitis Nerve entrapment	4 4	Arthritis Spasm/other	2 2
Guitarists	Blisters	5	Atrophy Nerve entrapment Contracture	1 1 1		
Bassists	Blisters/ callouses	4	Bursitis	2	Tendinitis Spasm/other	1 1
Organists	Tendinitis	5	Spasm Contracture	2 2	Sores Other	1 1

*N = number of respondents.

4. In light of the frequency with which musicians seek formal medical care for the evaluation of musically related injuries, we believe further study of these problems is necessary to improve diagnosis and therapy, and most importantly to develop preventive measures.

The response rate was low (30.3%) despite assurances of confidentiality and optional anonymity. Conversations with numerous musicians asked to participate in this study suggested that many professionals declined to participate because they feared loss of job or other benefits as a result of disclosure.

The observation of a high incidence of musculoskeletal injuries occurring in a group not traditionally associated with occupational trauma should not be surprising. Observation in other industries where monotonous, repetitious tasks are required have identified occupational rheumatic disorders and structural adaptations. In 1984 Kivi reported a relative risk of overuse injuries from 11.5 in butchers to 2.0 in typographers. In over 3000 occupationally related complaints, tenosynovitis, epicondylitis, and painful shoulder were the most common problems. Inexperience at a given task was not a risk factor, and it was not uncommon for high-level, skilled individuals who had been performing a given task for many years to develop a debilitating overuse injury.[3] Hadler and coworkers in 1978 found that when the hands of long-term employees of a woolen plant were examined for range of motion and compared radiographically, task-related differences in both structure and function consistent with pattern of usage could be demonstrated.[4] Recently, Bard et al. also found radiographic adaptions in the hands of 20 pianists consisting of axial radial rotation of the digits, especially the fourth and fifth, more so on the right hand, degenerative changes of the distal interphalangeal and metacarpophalangeal joints, and periosteal thickening and flattening of the phalangeal tufts associated with sclerosis.[5]

TABLE 4. **Number of Responsents Reporting Loss of Facility in Playing as a Result of Musically Related Injuries**

Loss of speed	55
Loss of control of major motions	45
Loss of control of fine motions	69
Loss of power (forte)	61
Loss of finger span	37
Other	19

Perhaps the earliest attempt to study and describe musculoskeletal dysfunction in musicians was compiled by the German investigator Siner in 1932 who described cramps, fatigue, and neuritic symptoms in players of various stringed instruments (including piano), without discussion of relative occurrence.[6] With the exception of this single publication, our review of the literature failed to locate any other studies, except for occasional anecdotes or case reports of peculiar musical maladies, until the study of Harman in 1982 concisely collated these reports.[7] This review classified reported ailments into six basic categories: dermatitis, nerve compression syndromes, occupational cramps, intraoral pressure problems, cardiac abnormalities, and miscellaneous. Harman pointed out that while the literature indicates there are health consequences for the professional musician, and some data are available on life expectancy and causes of death in musicians, statistical prevalence data for musculoskeletal or other systemic problems were lacking.

More recently Hochberg et al. characterized their experience with hand difficulties in 100 musicians, mostly pianists.[8] These authors found that right hand problems more common, and pain (21%), tightening (15%), curling/drooping/cramping (13%) and weakness (11%) were the most prevalent subjective complaints of 49 musicians they examined. Loss of control (34%) and decreased facility, endurance, or speed (each 18%) were the functional sequelae of these complaints. Leading diagnoses in this group were tendinitis (32%), nerve entrapments (15%), and mo-

The mean age of those reporting injuries in our study was 30 years and the median years of playing experience at symptom onset was 12 years, suggesting that inexperience is not a primary factor causing these disorders.

tor control disorders (27%). This series of patients was collected from referrals and telephone inquiries, and was not assembled in an attempt to determine prevalence of problems by surveying an unselected population of musicians. Nevertheless, we can detect a number of parallels between findings in their study group and ours. The majority of their patients experienced the onset of symptoms in mid-career (average beginning playing age 7.8 years, average age at onset of symptoms 31 years). The mean age of those reporting injuries in our study was 30 years and the median years of playing experience at symptom onset was 12 years. Their patients practiced 5 to 6 hours per day, ours 25 hours per week. These similarities suggest that inexperience is not a primary factor in these occupationally induced disorders, as Kivi demonstrated in other occupations.[3]

We were unable to associate specific diagnostic entities with instruments or technique or to identify which treatments or preventive measures are effective by means of our questionnaire. Such insights may be developed from clinical examinations and trials, and, in particular, the observation of the musician while playing his/her instrument, which we and others believe is often crucial to defining and managing various complaints, and adds a new dimension to the classical manner of physical examination.[6,8]

We suspect, however, from the results of our survey and the findings of Hochberg et al. as well as from clinical observation that the vast majority of musculoskeletal disorders of musicians will fall into the categories of nerve entrapment syndromes, muscle-tendon unit injury, and muscle cramps.[8]

While some neuropathies such as carpal tunnel syndrome, cubital tunnel syndrome[9] and cervical radiculopathies may be relatively easy to diagnose by clinical assessment and electrophysiology, less common disorders such as posterior interosseous neuropathy[9] and digital neuropathies[10] may be far more difficult to evaluate, and others such as lumbar radiculopathy, saphenous and common peroneal neuropathies[11,12] may result from positional factors not as directly associated with manipulating the instrument.

Although "tendinitis" or "tenosynovitis" is commonly and loosely used jargon, we have seen little in the way of cardinal signs of inflammation on examination of painful, tender tendinous structures, and suspect that such reported diagnoses reflect overuse syndromes with local microtrauma to collagenous tissues.

It is not surprising that muscular cramps of intrinisic and extrinsic muscles of the hand and arm are common in the face of repetitive sustained contraction on the basis of compressive ischemia as described by Simmons.[13] However, the role of "myofascial pain," while less well understood, may be equally contributory to "muscle" pain in such occupations. This term refers to regional musculoskeletal pain accompanied by "trigger zones." These are palpable, tender, often indurated portions of the muscle or fascia which, upon physical pressure or palpation, produce pain locally or in a target area that may be some distance from it. These lesions, as described by Travell and others, are not inflammatory but are probably based upon spinal cord facilitation of motor tone and autonomic outflow to segmentally related structures as a result of various somatic, visceral, and central nervous system input at the same level.[14]

Our impression from comments made by musicians in our survey is that many musicians will seek "medical" advice from colleagues or teachers and try quite unusual methods of treatment such as "practicing through the pain," using weighted objects on the extremities during practice, isolating individual digits for practice by binding others, and using analgesic balms. While more research is needed to clarify nosologic entities common to musicians and their causes, successful management will undoubtedly require a holistic approach. This may include not only local treatment but also correction of contributing factors such as nonadaptive stage chairs and lighting, and medical and psychological management of performance anxiety.[15] Recognition and avoidance of dangerous therapies as well as a better understanding of potentially preventive instruction such as Alexander technique and Thiberge principles may add to the occupational health of musicians.[16] Surgical intervention for neuromusculoskeletal injuries in musicians should be undertaken only after careful consideration of long-term benefit.[17]

References

1. Slonimsky N: Bakers Biographical Dictionary of Musicians, 7th ed. New York, Schirmer Books, 1984.
2. Henson RA, Urich H: Schumann's Hand Injury. Br Med J 1:900–903, 1978.
3. Kivi P: Rheumatic disorders of the upper limbs associated with repetitive tasks in Finland in 1975–79. Scand J Rheumatol 13:101–107, 1971.
4. Hadler NM, Gellings GB, Imbus HR, et al.: Hand structure and function in an industrial setting: influence of three patterns of stereotyped repetitive usage. Arthritis Rheum 21:210–220, 1978.
5. Bard CC, Sylvestri JJ, Dussault RG: Hand osteoarthropathy in pianists. J Can Assoc Rad 35:154–158, 1984.
6. Singer K: Diseases of the Musical Profession: a Systematic Presentation of Their Causes, Symptoms, and Methods of Treatment. Translated by W. Lakond. New York, Greenberg, 1932.
7. Harman SE: Occupational diseases of instrumental musicians. Literature Review. Maryland State Med J 31:39–42, 1982.
8. Hochberg FH, Leffert RD, Hiller MD, Merriman L: Hand difficulties among musicians. JAMA 249:1869–1872, 1983.
9. Charness ME, Purry GJ, Markison RE, Rosegay H, Barbaro NM: Entrapment neuropathies in musicians. Neurology 35 (Suppl. 1):26, 1985.
10. Cynamon KB: Flutists' neuropathy (letter). NEJM 305:961, 1981.
11. Schwartz E, Hodson A: A Viol paraesthesia (letter). Lancet, pp. 156, 1980.
12. Mladinick EK, DeWitt J: A newly recognized occupational palsy (letter). JAMA 228:695, 1974.
13. Simmons VP: Hand difficulties among musicians (letter). JAMA 250:3163, 1983.
14. Travell JG, Simons DG: Myofascial pain and dysfunction. In The Trigger Point Manual, Background and Principles. Baltimore, Williams and Wilkins, 1983, ch. 2.
15. Brantigan CO, Brantigan TA, Joseph N: Effect of beta blockade and beta stimulation of stage fright. Am J Med 72:88–94, 1982.
16. Taylor H: The pianist talent. In Principles of F. Matthias Alexander and Raymond Thiberge. New York, Taplinger Publ., 1979.
17. Crabb DJM: Hand injuries in professional musicians: a report of six cases. Hand 12:200–208, 1980.