Comparative study of epidemiological inquiries of the Musicians' Upper Limb disorders.

SHORT TITLE:
Comparison of epidemiological studies on Musician's Upper Limb disorders.

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ABSTRACT

The upper limb of musicians is the primarly involved in occupational diseases part of the body, followed by severe consequnces. Musicians are forced from time to time to visit several physicians to treat upper limb disorders. The problem is global. During the last 15 years several epidemiological studied were performed in specialized centers which analyse the upper limb disorders in musicians and validate the results of treatment. We compared 3 epidemiological studies related to this subject. Study 1 performed by R.Tubiana and P.Chamagne (Chirurgie, 1993) involved 234 patients, Study 2 performed by P.Amadio and G.Russotti (Hand Clinics, 1990) involved 46 patients and Study 3 performed by I.Ignatiadis and C.Dumontier (Acta Ortop Hellenica, 1998) involved 67 patients. Study 1 and 2 were compared to study 3 regarding following parameters: 1) Type of instrument, 2) Type of disease, 3) Treatment mode, 4) Results of treatment. The occurrence of overuse syndromes in pianists and violinists is higher than the occurrence of dystoniae in study 3 but the reverse is found in study 1. There is agreement between studies 1 and 2 regarding treatment. Comparing studies 2 and 3 the proportion of patients with dystoniae and overuse syndromes are almost equal, while nerve compression syndromes were equal in the Mayo series. Conservative treated patients exceed significantly the operative treated ones. The results between all three series are in agreement. Overuse syndromes are most common in all series, followed by nerve entrapment syndromes and dystoniae. In all series conservative treatment is the usual choice of treatment. The difficult treatment of dystoniae often the forces musician to quit professional playing. The results from study 3 are compared to the hand pathology found in an equal in number of patients from KAT General Hospital of Athens. In the general population overuse syndromes are 50% less often than in musicians, nerve compression syndromes are found in equal frequency, focal dystoniae are 20 times less often and hand hand injuries are more often.

Keywords: focal dystoniae, musicians' hand, overuse syndrome

INTRODUCTION

Perfect, unhampered function of the upper limb is essential to several professional group, like musicians. A musician has to practice and play his instrument for thousands of hours. More than 10.000 hours of practice are needed before is a musician able to give his first concert [11]. A musician may experience pain in many parts of his body: the instrument of hearing in the members of an orchestra, the temporomandibular joint in violinists, the lungs, the lips and the teeth in trompetists. The most often misused part of the body is the hand, because many musicians are forced to practice intensively, day by day playing 25 notes per second.
The spectrum of hand disorders is extensive, involving more than one medical speciality like Orthopedics, Neurology, Hand Surgery and Physiotherapy as well. Playing of a musical instrument implicates about 500 composite movements. A violinist who plays one Bachs' work for solo violin may perform more than 1200 movements per minute. The cause of hand injuries is the significant amount of repeated movements per minute which cause chronic mechanical overload and the continuous static pressure on certain parts of the body from specific instruments (violin, trumpet). There are also certain factors that deteriorate or occasionaly cause several disorders, as is the weight of the instrument, the bad posture, the abrupt increase of study hours, the change of the instrument and several preexisting anatomic aberrations or particularities. The most commo0n disorders of the Musicians' hands are:

1) Overuse syndromes, which are the most common occuring diseases and the most common cause of involuntary abstinence from their occupation. Several authors as Prof. Raoul Tubiana consider overuse syndromes as forms of tendonitis. Others like Dr. Ian Winspur claim that tendonitis is infliction of the whole tendon and its sheath, whereas in overuse syndromes the biochemistry of the musculotendinous unit is affected. Both of these disorders may coexist, or they may be stages of a common pathogenetic mechanism. According to the latter author tendonitis is discriminated in true tendonitis and pseudo tendonitis, which are commonly perceived as overuse syndromes. True overuse syndromes are more commonly found in women. Regarding treatment, non infectious painful syndromes of muscular origin, with no involvement of compartment syndromes, are rarely benefited from surgical treatment. Abstention from playing, change of position and technique during playing and gradual return is the most common form of treatment in overuse syndromes.
2) Nerve Compression Syndromes [1,5,13]. Nerve compression syndromes in the upper extremity of musicians display the same features found in these syndromes in the general population. Usually they occur when instrument playing is performed in certain positions: when the arm is abducted and the bow is horizontal thoracic outlet syndrome occurs, which rarely mandates surgery. It ameliorates with change of the position of playing and with rest. Ulnar tunnel syndrome may also occur in the left hand of violinists when the elbow is flexed excessively. Ulnar nerve compression at the elbow usually resolves with change of elbow flexion angle during playing, with the use of night splints, which keep the elbow in 40 degrees of flexion and with other conservative means and rarely mandates surgery. Carpal tunnel syndrome is very often met in pianists and in stringed instruments players, who use to play with their wrists in excessive flexion. From the published studies [1,5,13] it is concluded that rarely all above mentioned syndromes need surgical treatment, unless they are neglected.
3) Focal dystoniae or occupational cramps [4,6,7] have been described centuries ago. During the last 20 years the problem of dystoniae pathogenesis is lightened up, their pathophysiology has been elucidated and the techniques for diagnosis and treatment have been refined. Focal or functional dystoniae represent painless, stereotypic, localized movements encountered in some professional groups of patients where they perform many times per minute the same tasks. They are more often in males. During the last 20 years the organic and neurologic theory, as formulated by Marsden, Sheechy and Tubiana

replaced the psychiatric theory. Around 1950 the prevailing theories were divided into three groups (F.Hoberg).

a. The theory of central origin. Professional dystoniae are considered to have central, cerebral of subcerebral origin and may be of degenerative nature.
b. The peripheral origin theory. According to this theory dystoniae are due to peripheral causes, as muscle fatigue and neuromuscular disorders. Gowers believed that these disorders may be due to primary muscle pathology, where fatigue of certain muscles allows dominance of the antagonist muscle, leading to spasm.
c. The theory of functional aetiology. Initially Gowers and later Janet considered dystoniae as expression of psychic disorders, describing them as ticks and professional neuroses.

Musicians' dystoniae may be defined as disorders of movement control, which appear only when a certain movement is regularly and monotonosouly performed, which can be thoroughly described. Dystoniae are painless, the reflexes are preserved and EMG is normal. Dystoniae share the same pathophysiologic mechanism with writers spasm. Focal locomotory disorders may be considered to be one of three types:

1) Involuntary 4^{th} and 5^{th} finger flexion in pianists, occasionaly followed by ulnar neuritis, 2) flexion of the 3^{rd} and 4^{th} finger in guitarists, sometimes combined with 5^{th} finger abduction and 3) 3^{rd} finger extension in clarinetists. A common finding is the destabilization of the 1^{st} carpometacarpal (basal) joint of the thumb.To this condition predisposes a congenitally existing ligament laxity and the technique and the posture as well. Progressively the anterior oblique ligament is affected, condition which predisposes to late osteoarthritis. The above mentioned conditions may be treated with rest, abstinence, physiotherapy, night splints, muscle relaxants, anxiolytics, muscle strenghtening and several combinations [2,3,14]. Considerable is the introduction of botulinum toxin in the treatment of dystoniae. This technique involves the injection of the toxin into the neighbouring non affected muscles, making use of its paralytic potential. Today there is high competition between high level musicians forcing them to practice much more, increasing probably the occurrence of hand disorders.

We attempted to study the existing epidemiological studies regarding musicians' hand pathology, to compare them and to contrast them with a epidemiological study, regarding upper limb disorders in the general population.

MATERIALS-METHODS

There exist several epidemiological studies from some specialized centers regarding musicians' upper limb disorders, who analyze their disorders and injuries.

Study 1. In Europe serious research has been performed in 1993 by Prof. Raoul Tubiana and the physiotherapist Ptillippe Chamagne, who studied 600 musicians. This series involved 243 pianists and 98 violinists. Eighty-eight of the pianists suffered of functional, focal dystoniae, 73 of overuse syndromes and 48 of trauma or nerve compression. Foutry-three (17%) of them was operated. Thirty-three of the violinists suffered of focal dystonie, 36 of overuse syndromes and 19 of trauma or nerve compression. Ten (~ 10%) of them was operated.

Study 2. A significant study was published in 1993 by P. Amadio and GM Russoti from the Departments of Hand Surgery and Physiotherapy of the Mayo Clinic. One-hundred musicians have been examined; 86 of them were professional with mean age 29 years. The first 40 of them had been recently reexamined and their records were complete, regarding demographics, clinical picture, diagnosis, therapy and its result. Twenty-nine of them were female and 11 were male and 6 of them played 2 different instruments. Most of them played 10-40 years 4-6 hours daily and the duration of the symptoms was 1 year and 8 months on average.

The results of treatment are classified according to a protocoll, which examines the causes, the music instrument, the disease, the treatment and its results and combinations of the above mentioned parameters as well [1].

Several research papers have been published by F.Hoberg in 1990, regarding musicians upper limb focal dystoniae [1,4].
In the Mayo Clinic series only percentages are mentioned, without reference to patient numbers.
The Mayo Clinic series yielded following results:

1. In reference to the music instrument :
   a. Pianists 56.5%
   b. Violinists 13%
   c. Guitarists 8.7%
   d. Tympani players 6.5%
   e. String Instruments 2%

2. In reference to the disease:
   a. Overuse syndromes 31%
   b. Nerve compression syndromes 22.5%
      (CTS 13%, Pronator syndrome 3.5%)
   c. Focal dystoniae 9%
   d. Trigger finger 4.4%
   e. Joint instability 7%
   f. Trauma and compications 12%
   g. Ganglia 7%

3. In reference to the treatment:
   a. Conservative treatment 84%
   b. Operative treatment 16%

Cortisone injection was performed in 26% patients and 85% of them returned to their previous employment.
Study 3. The first article in Greece who studied musicians' upper limb was published in Acta Orthopaedica Hellenica in 1998 by I.Ignatiadis and C.Dumontier. This was an epidemiological study which is used as a reference of general population upper limb pathology. This study was performed analysing the personal records of Dr. Christian Dumontier from the Paris Hand Institute and involved 67 patients examined between 1995 and 1997. All patients were musicians: professionals, semiprofessionals or music students. Everyone of them was practicing for hours every day and presented with problems in one or both upper limbs. In this series we examined the causative and the promoting factors of upper limb injuries, their epidemiology, demographic data, the treatment and the results of it. This study had following results:
1. From 67 patients of mean age 34.6 years 35 were women and 32 men, 61 had unilateral disorder and 6 bilateral, 15 had also another orthopedic disorder. The mean time between the first manifestation and the last follow-up was 29 months. The mean time of daily practice was 4.5 hours and the time from initiation of practicing was 6-47 years. Fifty-eight patients (77.2%) were professionals, 11 (12.8%) were students or seminprofessionals.
2. Regarding the music instruments 20 were patients, 15 violinists, 11 guitarists, 6 tympanists, 3 playing wind instruments, 3 playing contrabass, 2 playing violoncello and 3 playing more than 1 instrument.

3. The following pathogenetic factors have been implicated in the pathogenesis of upper limb disorders:

a. extended period of practice: 38 patients with overuse syndrome, nerve compression syndromes and dystoniae.
b. psychological factors were implicated in 5 patients with dystoniae
c. change of instrument in 2 patients
d. trauma and related complication in 18 patients (stiffness, malunion, instabilities)

e. anatomic factors (congenital or acquired) in 7 patients like: flexor tendon bands (1 case), ulnar plus variance (1 case), lax interphalangeal (2 cases) or metacarpophaleangeal joints (3 cases).
f. Inappropriate playing posture (4 cases).

4. Regarding the type of disorder per instrument and sex:
a. Twenty-one patients (7 men and 14 women) had overuse syndromes and tendonitis: 6 were pianists, 3 guitarists and 6 patients playing other instruments.
b. Eight patients had nerve compression syndromes (4 cases with CTS and 4 with Thoracic outlet syndrome): 2 pianists, 2 guitarists and 4 patients playing other instruments. The sex distribution was equal (4+4).
c. Focal dystoniae have been diagnosed in 8 cases, 4 men and 4 women. One was pianist, 2 violinists, 4 guitarists and 1 was playing other instrument.
d. Cysts have been diagnosed in 7 cases (1 male and 6 females): 1 pianist, 2 violinists and 4 were playing other instruments.
e. Degenerative arthritis was diagnosed in 6 patients (2 males and 4 females): 3 pianists, 2 violinists, 1 guitarist and 2 were playing other instrument.
f. Cervical spine problems were found in 4 patients (2 males and 2 females): 1 guitarist, 1 pianist, 1 violinist and 1 was playing other instrument.
g. Trigger fingers have been diagnosed in 5 patients (2 males and 3 females): 2 pianists and 2 violinists.
h. Metacarpophalangeal joint instability was diagnosed in 3 cases and interphalangeal joint instability was diagnosed in 2 cases (2 males and 3 females): 3 pianists, 1 violinist and 1 guitarist.
i. Trauma and their complications were found in 18 patients (7 males and 11 females): 3 guitarists, 4 pianists, 3 violinists and 8 were playing other instruments.

5. Regarding the treatment: 9 patients were operated, 9 were treated with injection and physiotherapy, 43 were treated with physiotherapy and dynamic splinting, 4 were subjected to psychotherapy and physiotherapy, 12 treated with simple rest and 14 with combined treatment.

6. Regarding the results of treatment 53 patients recovered fully or improved significantly, 2 patients ceased playing for 6-12 months, 5 patients reduced the intensity of playing, 1 was forced to change instrument and 6 quitted proffessional playing.
In order to compare the results of the 3 series the percentage values in our series were compared with those of the Tubiana-Chamagne (Comparison A) and the Mayo Clinic (Amadio-Rusotti) series (Comparison B). At the end of the paper a comparison is made between our results and the results of a study were all upper limb disorders in a general population have been recorded. These patients have been examined in the Outpatient Clinic of the Hand Surgery and Microsurgery Unit of the KAT Accident Hospital. Among 67 patients of all profession who have been examined following diseases have been ascertained:

a. Nerve compression syndromes: 8
b. Tendonitis-overuse syndromes: 11
c. Trauma and complications: 35
d. Cysts: 3
e. Arthritides: 3
f. Cervical spine pathology: 3
g. Trigger finger: 3
h. Joint instability: 3
i. Functional dystoniae: 0

In a similar study of 670 patients, 10 times more than the abovementioned series, from a general population following diseases have been ascertained:

a. Overuse syndromes:	122
b. Functional dystoniae:	4
c. Cysts:	48
d. Degenerative Arthritides:	35
e. Cervical spine pathology:	48
f. Trigger finger:	49
g. Joint instability:	18
h. Trauma and complications:	18
i. Other diagnoses (Congenital disorders, Dupuytren disease):	42

RESULTS

The results of this study may be classified in three categories:

A) Comparative study A(comparison between Tubiana-Chamagne and I.M. series) [Table I].
B) Comparative study B(comparison between Mayo Clinic and I.M. series) [Tables II a,b,c].
C) Comparative study C(comparison between I.M. series and general population) [Table III].

A. Comparative study A [Table I].

A comparison was made between the series of Tubiana-Chamagne and the Institute de la Maine series by Drs. Ignatiadis and Dumontier. These series have been compared regarding disorder and therapy in absolute numbers and % percentage. In both series the overuse and dystoniae percentage is similar between the two series. In pianists in the T-C series dystoniae prevail, but in our series overuse syndrome are more common. In violinists these percentages are similar, but in our series overuse syndromes are more common. Regarding results of therapy there is complete agreement between the two series, given that in both series only a small percentage of patients was treated operatively. In our series only 20% of pianists was operated (4 patients) and in the other series only 17% (43 patients) was operated. Regarding violinists, in our series 1 patient (6.5%) was operated and in the other series 10 patients (10.2%) were operated.

B. Comparative study B [Tables II a, b, c].

A comparison was made between Mayo Clinic and I.M. series. In the Mayo series only percentages are reported, in contrast to the I.M. series. We compared a) the type of the instrument, b) the disorder, c) the treatment.

Regarding the type of the instrument, in the I.M. series pianists are significantly less than those of the other series, while violinists and guitarists are more than twofold from the Mayo series. (Table IIa). Regarding the type of disorder there are similar finding between the two series. Exceptions are the nerve compression syndromes, which are two times more common than the Mayo Clinic series, due to the presence of more CTS. Upper limb injuries and their complications are two times more common in the I.M. series. (Table II b) Regarding the treatment choice in the Mayo series 84% of the patients was conservatively treated, while 16% was operated. The percentage of patients with cortisone injection was two times greater in the Mayo series. In the Mayo series after completion of the treatment 55 patients (82.01%) returned to their previous occupation, while in the Mayo series only 85% did.

C. Comparative study C [Table III].

We compared the I.M. series with the results from the examination of 67 patients of the greek general population and from another study of 670 patients. We may call the last KAT series. All data have been obtained from the medical records of the patients. Both countries belong to the Mediterranean, with similar human resources and nutrition. The greek and the french population may be regarded as similar from an epidemiological point of view. In the general population of a Mediterranean country like Greece nerve compression syndromes are as common as in musicians, but they are treated operatively more often. Tendonitis is more common in the general population and 50% less in musicians. Dystoniae are very rare in the general population. Among 67 musicians 8 cases with dystonia were detected, while in 67 patients of the general population none. In a greater population of 670 patients of the general population only 3 cases with dystoniae were detected. One of them was music player (playing bouzouki), one was typist and the third was Karystos rock technician. Upper limb injuries were less common in musicians. When the subgroups of general population, consisting of 67 and of 670 persons, were compared the proportions of the several conditions were equal between these two groups with only exception the existence of dystoniae in the larger group.

DISCUSSION

It seems that every instrument may cause upper limb disorders. The most commonly used instruments are the piano and the violin, so it is no surprise that hands of pianists and violinists are most commonly involved. In the I.M. series the most common disorder of pianists was the overuse syndromes, just as in violinists. Second in occurrence are in both series the focal dystoniae. In guitarists focal dystoniae are more common along with the overuse syndrome. The overuse syndrome may sometimes be accompanied by a nerve compression syndrome (3 cases) or by dystonia (1 case). We also treated one patient with double crash syndrome (CTS and thoracic outlet syndrome) and three with isolated nerve compression syndrome. All nerve compression syndromes were mild and were treated conservatively. The majority of overuse syndromes were treated also conservatively with rest and physiotherapy. Only one case with CTS was operated. More resistant to therapy were patients with functional dystoniae. Four of them were forced to give up professional music playing and one changed instrument. Due to overuse syndrome, a few patients were forced to discontinue playing for a long period of time, but only two of them quit playing. We there was a strong psychological influence on the disease its prognosis was deteriorated. In three patients with dystonia the basal joint of the thumb got loose. The comparison of our series with the Tubiana-Chamagne one revealed the existence of similar results. From the population of 243 pianists only 17% and from 98 violinists only 10% was was operated, percentages similar to those of the I.M. series. One significant difference is the percentage of patients treated with steroid injections, which is double than the percentage reported in the Mayo series. In the I.M. series 55 patients (82.01%) returned to their previous employment, while in the Mayo series only 85% did. When the I.M. series was compared to the general population pathology, from the Hand Surgery Unit of the KAT Hospital, tendonitis and overuse syndromes were more common in musicians. Focal dystoniae are 20 times more common in musicians. The eight dystoniae (11.2%) found in 67 musicians is underestimation of the extent of the problem, since only the more severe forms of dystoniae are referred to specialized Hand Units.In the Mayo series the percentage of dystoniae is 9%. Nerve compression syndromes are detected in musicians with the same frequency as in the general population, but they are rarely treated operatively.

Musicians suffer rarely of injuries, compared to other professions, because in the general population are included industry workers and patients who expose frequently their upper limb in traumatic conditions in labor accidents. Musicians also probably avoid exposing their hand to dangers.

Conclusively, upper limb disorders in musicians are frequent and may affect their carreer substantially. Early diagnosis and appropriate treatment, usually conservative are essential.

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Table I. Comparison between I.M. series with Tubiana-Chamagne series.

	I.M. series	Tubiana-Chamagne series
PIANISTS	20	234
Overuse + tendonitis	6 (30%)	73 (31.2%)
Injuries, Nerve compression	9 (45%)	48 (20.4%)
Dystoniae, functional	1 (5%)	88 (37.6%)
Operated	4 (20%)	43 (17%)
VIOLINISTS	15	98
Overuse + tendonitis	6 (40%)	36 (36.1%)
Injuries, Nerve compression	5 (33.3%)	19 (19.2%)
Dystoniae, functional	2 (13.3%)	33 (33.1%)
Operated	1 (6.5%)	10 (10%)

Table IIa. Comparison in relation to the type of instrument.

INSTRUMENT	MAYO SERIES		I.M. SERIES	
	Number	%	Number	%
Violin	20	29.9	26	56.5
Piano	15	22.2	6	13
Guitar	11	16.4	4	8.7
Wind Instrument	6	8.9	3	6.5
Stringed Instrument (Cello, Contrabass)	5	7.4	1	2.2
More than 1 instruments	3	4.4	---	---
Total	67	100	46	100

Table IIb. Comparison in relation to the disorder.

DISORDER	I.M. SERIES		MAYO SERIES	
	Number	%	Number	%
Overuse, Tendonitis	21	31.1	--	31
Nerve compression	8	11.2	--	22.5
Thoracic outlet syndrome	4	5.6	--	6
Carpal tunnel syndrome	4	5.6	--	13
Pronator teres syndrome	---	---	--	3.5
Focal dystonia	8	11.2	--	9
Degenerative arthritis	6	8.4	--	7
Cervical Spine Pain	4	5.6	--	---
Trigger finger	5	7.4	--	4
Joint instability	5	7.4	--	7
Trauma and complications	18	25.2	--	12
Wrist ganglion	7	10.2	--	2

Table IIIc. Comparison in relation to the treatment method.

TREATMENT	I.M. SERIES		MAYO SERIES	
	Number	%	Number	%
Conservative	58	86.7	---	84
Steroid injection	9	13.3	---	26
Operation	9	13.3	---	16
Treatment Length	1-12 months	---	1-6 months	
Return to previous employment	55	82	---	85

Table III. Comparison between our patiens series and the general population.

DISORDER	I.M. SERIES 67 Musicians (Paris)	KAT SERIES 67 Persons	KAT SERIES 670 Persons
Overuse + tendonitis	21	11	123
Nerve compression syndromes	8 (none operated)	8 (5 operated)	93
Functional dystoniae	80	0	3
Cysts	7	3	48
Degenerative arthritides	6	3	35
Cervical Spine Syndromes	4	3	47
Trigger finger	5	3	49
Joint instability	5	2	18
Trauma and complications	18	35	301
Others(congenital disorders, Dupuytren)	---	3	42