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Injuries to runners

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The various injuries which can be attributed to the effects of running are reasonably well known. In nearly all cases the etiology can be traced to conditions of overuse or dynamic overload as causal or contributing factors. Sudden accelerations (and decelerations) which create extreme forces during activities such as sprint running can frequently result in strain injuries. Although distance runners are likewise subject to conditions of dynamic overload and the various injuries which may occur as a result, they are more commonly affected by overuse syndromes. While there is abundant literature which describes the etiology, symptoms and management of various injuries sustained by runners, there is limited information regarding the incidence and distribution of these injuries with respect to such variables as classification, site (anatomic) and competitive event (running). A knowledge of the relative incidence, treatment and results of treatment of injuries to runners should provide not only a basis for better management but also a probable basis for increased utilization of preventive measures and earlier recognition and treatment of these injuries.

METHODS

The data presented in this paper were obtained from the files on athletic injuries from an orthopedic clinic* with a large practice in athletic medicine. These files contain over 4,850 records of patients treated for injuries related to sports participation. The cases included in this report were selected from the category of track and field injuries and were limited to those which could be attributed to running as a causal factor. A number of cases involving injuries to runners were deleted from consideration when it was apparent that the injuries were sustained as a result of a traumatic event such as a collision or fall. A smaller number of cases also were deleted when examinations revealed an injury to be a recurrence of a recent injury sustained in an activity other than running. The number of cases included in this report after various exclusion criteria were applied was 109. These cases were treated during the approximate period from 1955 to 1972.

The population was composed of runners from the University of Oregon and to a lesser extent Oregon State University and from high schools in the Eugene, Oregon area. It also included a small number of athletes who were referred for treatment from other areas and some who were treated while they were in the area on a temporary basis to compete in meets or participate in training camps.

The data obtained from the medical records were categorized with respect to a number of variables. The latter include the runners' preferred events, the type of injury, and the treatment and disposition of the

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injuries. These data are presented in tables I through VIII.

In categorizing runners' events, a category designated as "unknown" was included. This was necessary in 19 cases in which the information from the records was insufficient to determine the preferred competitive event of the individual. The criteria for classifying events was as follows: *sprint*—up to 440 yards; *middle distance*—over 440 yards to one mile; and *distance*—over one mile.

In a few cases, difficulties were experienced in determining the final result of injuries because records were incomplete. The terms used in this survey to indicate the final result were "good", "apparently good", "poor", and "unknown". A designation of "apparently good" was indicated when the records contained information to indicate that the patient was asymptomatic and had resumed some degree of training or competitive activity but failed to include a specific statement of discharge. This was the largest category and was characterized by failure of a patient to appear for a final appointment.

The term "poor" indicated the patient was not able to resume competitive activity following treatment. The final result of a case was designated as "unknown" when the information provided by the record was insufficient to allow classification in to any of the previous categories. The latter applied mostly to transient patients who were subsequently referred to physicians near their places of residence.

The classification of injuries was made according to definitions provided in the glossary of terms in the Standard Nomenclature of Athletic Injuries of the American Medical Association.[1] However, no attempt was made to distinguish between tendinitis and tenosynovitis. The former term was used exclusively.

RESULTS

The incidence of injury by category and event is shown in Table I. It can be seen that 76% of all injuries fall within the categories of strains, fractures, sprains and tendinitis with 38% of the total accounted for by musculotendinous strains. Further examination of Table I shows that in seven of the eleven categories, distance runners were the most frequently injured class of runners and sustained 41% of all injuries. The second highest incidence of injury occurred among sprinters who sustained 24% of the total injuries. The injuries to sprinters were predominantly strains which accounted for 50% of all strain injuries and 16% of all injury categories surveyed.

An examination of the anatomical distri-

TABLE I Distribution of Injuries by Category and Event

Category of Injury	Classification of Running Event					Total	% of Total
	Sprint	Mid-dist	Distance	Joggers	Undet.		
Strains (musculotendinous)	18	2	12	—	4	36	33.1
Strains (avulsions)	3	—	1	—	1	5	4.6
Fractures (stress)	2	5	7	—	3	17	15.6
Sprains	2	2	3	3	2	12	11.0
Meniscal lesions	0	1	2	0	0	3	2.8
Tendinitis	—	2	9	—	2	13	11.9
Subluxation (patella)	—	—	3	—	3	6	5.5
Chondromalacia (patella)	—	3	2	—	—	5	4.6
Osteochondritis (patella)	—	—	4	—	1	5	4.6
Metatarsalgia	—	1	—	—	1	2	1.8
Low back syndrome	—	—	1	—	1	2	1.8
Bursitis	—	—	1	—	1	2	1.8
Synovitis	1	—	—	—	—	1	0.9
Total	26	16	45	3	19	109	
% of total	23.8	14.7	41.3	2.8	17.4		

TABLE II Strains and Avulsion Injuries

Site of Injury	Sprint	Mid-dist	Distance	Joggers	Undet.	Total	% of Total
A. Strains							
Rectus femoris	3	—	1	—	2	6	16.2
Hamstrings							
Medial	3	1	—	—	—	4	10.8
Lateral	6	—	2	—	—	8	21.6
Adductors	1	—	1	—	1	3	8.1
Gastrocnemius	2	—	1	—	—	3	8.1
Peroneus brevis	—	1	—	—	—	1	2.7
Flexor digitorum brevis	—	—	1	—	—	1	2.7
Tensor fascia lata	—	—	—	—	1	1	2.7
Popliteus	—	—	1	—	—	1	2.7
Plantar fascia	1	—	1	—	—	2	5.4
Achilles tendon	1	—	1	—	—	2	5.4
Patellar tendon	—	—	1	—	—	1	2.7
Back strain	1	—	1	—	—	2	5.4
Arch strain (foot)	—	—	2	—	—	2	5.4
Total	18	2	13	0	4	37	
% of total	48.6	5.4	35.1	0	10.8		
B. Avulsions							
Asis*	2	—	—	—	—	2	
Tarsal scaphoid	1	—	—	—	—	1	
Calcaneus	—	—	1	—	—	1	
Femoral condyle	—	—	—	—	1	1	
Total	3	0	1	0	1	5	

* ASIS—Anterior Superior Spine of the Ilium

TABLE III Fractures

Stress Fractures	Sprint	Mid-dist	Distance	Joggers	Undet.	Total	% of Total
Tibia	1	2	2	—	2	7	41.2
Metatarsals							
III	—	—	4	—	—	4	23.5
IV	1	—	—	—	—	1	5.9
Fibula	—	1	1	—	1	3	17.6
Cuneiform	—	1	—	—	—	1	5.9
Tarsal Scaphoid	—	1	—	—	—	1	5.9
Total	2	5	7	0	3	17	
% of total	11.8	29.4	41.2	0	17.6		

bution of strain injuries in Table II reveals that the most frequently injured muscles were the lateral hamstrings (8), the rectus femoris (6), and medial hamstrings (4). The combined hamstring injuries accounted for 32% of all strains. Nine of the twelve hamstring injuries (Table II) occurred among sprinters and constituted the most frequent specific injury by event observed in this survey by a considerable margin.

The distribution of fractures among the runners surveyed is presented in Table III (avulsion fractures were considered with strains in Table II). This table reveals that of the 17 stress fractures, 7 (41%) involved the tibia. The greatest incidence of fractures

with respect to both anatomic location and preferred competitive event was 4 fractures of the third metatarsal by distance runners. Distance runners led in numbers of fractures with 7 followed by middle-distance runners with 5.

The distribution of soft tissue injuries (Table IV) appears to be spread evenly by event classifications and sites of pathology. There were eight cases of sprains and meniscal injuries associated with structures at the knee joint and six sprains of the ankle joint and two sprains associated with injuries to the foot. It is apparent that distance runners had the greatest number of sprains with six followed by middle-distance runners and joggers with three each. Sprinters had two sprains. The structure most frequently injured in the category of sprains was the anterior talo-fibular ligament which was injured 4 times.

Tendinitis (Table V) was most common among distance runners who sustained 69% of the injuries in this category. Sixty-nine percent of all cases of tendinitis involved the Achilles tendon in this survey.

The remaining categories of injuries shown in Table I collectively account for 23 of the 109 total cases surveyed or approximately 21%. Three of the remaining categories are related to pathology of the patella; i.e., subluxation chondromalacia, and osteochondritis. These three categories collectively represent 16 cases of which 9 were distance runners, 3 were middle distance runners, and 4 cases whose preferred running events were not known. The numbers of cases with metatarsalgia, low back syn-

TABLE IV Distribution of Sprains and Meniscal Lesions

Sprains	Sprint	Mid-dist	Distance	Joggers	Undet.	Total	% of Total
Knee							
Collateral ligament							
Medial	—	—	1	—	—	1	6.2
Lateral	—	1	—	—	—	1	6.2
Other							
Post lateral aspect	1	—	—	—	—	1	6.2
Iliotibial band	—	—	1	—	—	1	6.2
Superior med aspect	—	—	—	1	—	1	6.2
Ankle							
Lateral	1	1	1	1	—	4	25.0
Medial	—	—	1	—	1	2	12.5
Foot	—	—	—	1	1	2	12.5
Meniscal lesions							
Medial meniscus	—	1	—	—	—	1	6.2
Lateral meniscus	—	—	2	—	—	2	12.5
Total	2	3	6	3	2	16	
% of total	12.5	18.7	37.6	18.7	12.5		

TABLE V Distribution of Tendinitis

	Sprint	Mid-dist	Distance	Joggers	Undet.	Total	% of Total
Achilles tendon	—	2	6	—	1	9	69.2
Extensor tendon	—	—	1	—	—	1	7.7
Extensor hallucis longus tendon	—	—	1	—	—	1	7.7
Patellar tendon	—	—	—	—	1	1	7.7
Anterior tibialis tendon	—	—	1	—	—	1	7.7
Total	0	2	9	0	2	13	
% of total	0	15.4	69.2	0	15.4		

drome, bursitis, and synovitis were quite small with no more than 2 injuries in any of these categories nor more than one case associated with any particular running classification under any category of injury.

Tables VI, VII and VIII show the type and incidence of treatment, the duration of treatment, and the result according to category of injury.

Treatment of injuries was classified as either conservative or surgical, with several categories of conservative treatment. In most of the 6 cases in which surgical procedures were involved, a period of conservative treatment preceded the surgeries. The 6 cases in which surgery was included constituted only 5.5% of the total cases surveyed. Most of the 103 cases treated conservatively involved more than one of the seven categories of conservative treatment. Table VI reveals the most frequently prescribed treatment was rest followed by one or more forms of physical therapy. The latter category includes therapeutic exercise, whirlpool, heat, ultrasonic treatment, cold, etc. Although rest was utilized as a treatment in nearly all categories of injuries, it was prescribed most extensively for fractures, tendinitis, sprains and meniscal injuries with respective percentages of 100, 92, and 73 of the numbers of cases in these categories. Rest was also prescribed for 71% of the strain injuries. Physical therapy was utilized most extensively for treatment of tendinitis with over 61% of the cases receiving some form of this treatment. Physical therapy was used in a high percentage of cases involving subluxation and chondromalacia of the patella; however, the total number of cases in these categories was quite small with 6 and 5, respectively. Physical therapy was also included in 39% of the strain injuries and

TABLE VI Treatment of Injuries by Categories

Injury	(Cases)	Rest	PT	Analgesic	Steroid	Immobilization	Supported Ambulation	Gait Correction	Other	Surgical
Strains and avulsions	(41)	29	16	5	1	0	0	3	1*	0
Stress fractures	(17)	17	9	2	0	4	6	0	0	1 (exp biopsy)
Sprains and meniscal tears	(15)	11	7	1	2	0	2	0	0	3
Tendinitis	(13)	12	8	5	3	0	2	0	0	0
Subluxation (patella)	(6)	3	3	0	0	1	0	0	0	2
Chondromalacia (patella)	(5)	5	3	2	0	1	0	0	0	0
Osteochondritis (patella)	(5)	5	0	1	0	0	0	0	0	0
Metatarsalgia	(2)	2	1	0	0	0	0	0	2**	0
Low back syndrome	(2)	0	1	0	0	0	0	2	0	0
Bursitis	(2)	0	0	2	2	0	0	1	1**	0
Synovitis	(1)	1	0	1	1	0	0	0	1**	0
Total	109	85	48	19	9	6	10	6	5	6
% of total		78	44	17	8	5	9	5	5	5

* DMSO
** Foot Pads

TABLE VII Duration of Treatment by Category of Injury

Injury Categories	Total	Time Under Treatment					
		1 Visit	2-7 Days	1-3 Wks	3-8 Wks	2-6 Mo	Over 6 Mo
Strains and avulsions	41	31	4	3	0	0	0
Stress fractures	17	2	2	3	8	3	2
Sprains and meniscal tears	15	6	1	1	4	3	0
Tendinitis	13	7	0	1	2	1	2
Subluxation (patella)	6	3	0	0	0	1	2
Chondromalacia (patella)	5	2	0	1	1	1	0
Osteochondritis (patella)	5	3	0	0	1	1	0
Metatarsalgia	2	0	0	1	0	1	0
Back syndrome	2	2	0	0	0	0	0
Bursitis	2	1	0	1	0	0	0
Synovitis	1	0	0	0	1	0	0
Totals	109	57	7	11	17	11	6

TABLE VIII Disposition of Injuries by Category

Injury Category	Result			
	Unknown	Good	Apparently Good	Poor
Strains and avulsions	0	6	35	0
Stress fractures	0	14	3	0
Sprains and meniscal tears	2	4	9	0
Tendinitis	2	0	11	0
Subluxation (patella)	1	1	3	1
Chondromalacia (patella)	0	2	3	0
Osteochondritis (patella)	0	0	5	0
Metatarsalgia	0	2	0	0
Low back syndrome	0	0	2	0
Bursitis	0	0	2	0
Synovitis	0	0	1	0
Total	5	29	74	1

nearly 47% of the ligament and meniscal injuries.

Analgesic was administered either orally or intramuscularly in 19 cases. Although not used extensively, various analgesics were prescribed in the more serious cases of strains and tendinitis and for the two cases of bursitis. It was also used in two cases of chondromalacia of the patella.

Steroid infiltrations were utilized sparingly and were limited, for the most part, to the treatment of tendinitis, bursitis and synovitis. The use of immobilization and supported ambulation was largely limited to the management of fractures; however, ambulation with support was utilized in the management of 2 cases involving ligamentous injury and 2 cases of tendinitis.

Gait correction was used in only six cases. Both of the cases with low back syndrome were instructed in running with a flat back to alleviate postural conditions which were diagnosed as the probable causes of the difficulties.

The surgical procedures consisted of 3 meniscectomies and 2 tibial tubercle transplants. The latter procedures were used to correct subluxing patellae. The remaining surgery was an exploratory biopsy.

Table VII reveals that 57 patients or approximately half the cases were seen only once by a physician. The majority of these

cases involved patients with mild strains. Seventeen cases received treatment from 3 to 8 weeks. Fractures, sprains and meniscal injuries were the predominant pathology among this group. Eleven patients received treatment for a period from 1 to 3 weeks while an equal number were under treatment from 2 to 6 months. The former period involved 3 strain injuries and 3 fractures while the most representative injuries for the longer period were fractures, sprains and meniscal injuries. The categories of injury which required treatment in excess of 6 months were fractures (2), tendinitis (2) and subluxation of the patella (2).

Because of the failure of patients to keep appointments in a number of cases it was not possible to accurately determine the final disposition of their injuries. The category in which the records were most complete was fractures. In 14 cases (Table VIII) it was possible to determine that the patient had fully recovered. Seventy-four patients were reported to have recovered. This judgment was rendered on the basis of the patient's condition at the time of his last visit. Only one patient included in this survey definitely failed to recover to the extent that he could resume running. However, in two instances patients who were not improving at the time of last contact probably could not have run competitively again. These and three other patients who were not seen enough to judge the probable extent of their recoveries were included in the category of "unknown" with respect to the disposition of injury.

DISCUSSION

It is important to note that the data of this survey are more reflective of the incidence of injuries which come to an orthopedic office rather than a true incidence of the various injuries incurred by runners. Since the majority of cases handled by orthopedic specialists are only the more serious problems referred by other physicians, coaches and trainers, it is difficult to obtain a true estimate of the incidence of injuries. For example, it is the estimate of the head trainer of the University of Oregon Athletic Department* that only 1 out of 20 cases of tendinitis is referred for treatment. However, this situation may not be representative of the total period of the survey since this estimate may be biased by the recent practice (since 1969) in which an orthopedist examines and prescribes treatment on a weekly basis during visits to the training room. We have made no attempt to determine the probable ratio of true incidence to that indicated by clinical records for the other categories of injury considered in this report, but we have assumed that a similar condition exists for some of the other categories. It should also be noted that the arrangement described above is peculiar to the University of Oregon Athletic Department which represents only a part of the athletic medicine practice represented in this survey.

The probable differences in over all incidence of injuries which result from running to that reflected from clinical records is evident to a degree from a comparison of the results of the present survey with one by Glick and Katch[2] on injuries to joggers. Their survey included several injuries which were not found in the present report and there are considerable differences in distributions within major categories. Some explanations for these differences are apparent. The relatively higher percentage of strains reported by Glick and Katch (43% vs. 33%) and the lower percentages of stress fractures (1% vs. 16%) and tendinitis (5% vs. 12%) can be accounted for by the considerable differences in the populations of the two surveys. The survey of Glick and Katch included 120 "joggers" ranging from 19 to 70 years of age. Approximately 70% of this group were described as novices with respect to jogging. In contrast the subjects of the present survey were, with few exceptions, competitive runners. It is a reasonable assumption that competition would exert a selective influence with respect to the fitness of individuals for running. However, the considerably greater percentages of "over-

* Larry Standifer, RPT, Head Trainer, Athletic Department, University of Oregon Eugene, Oregon

use" injuries would also seem reasonable when one considers that a competitive distance runner would be likely to cover more than 10 times the distance of a typical jogger in a period of training and at a significantly faster pace. These latter factors could account for the differences in stress fractures and tendinitis in the two surveys.

Although muscle strain was the category with the highest incidence of injury in both surveys, injury of the triceps surae group accounted for 60% of the strains incurred by the joggers surveyed by Glick and Katch but only 8% of the strains to the group made up predominantly of competitive runners in the present survey. This may be an effect of selection as was mentioned earlier but also could be interpreted as indirect evidence of the effect of conditioning as a prophylaxis to strains, particularly in the triceps surae group.

From the results presented in Tables I through V, it is evident that among the various categories, distance runners were most prone to injuries, having led in all categories of injury except strains and chondromalacia of the patella. They were the second most frequently injured group in these latter categories. The cases of chondromalacia were too few in number to indicate trends, however, chondromalacia is frequently a result of overuse and may properly be considered a problem more common to distance runners.

In order to explain the results with respect to the incidence of injuries it is helpful to consider factors which can cause a predisposition for injury. It has been noted by James and Brubaker[3, 4] that the effects of abnormal mechanical function in the lower extremities will quickly be revealed as a result of the stresses placed on musculoskeletal structures during training and competition. While pronounced structural deviations (e.g., genu valgum, genu varum, pes planus, torsional malalignment, etc.) may not cause difficulties for sedentary individuals, slight to moderate deviations may result in severe problems for the competitive runner who covers over 100 miles in a week of training.

In addition to the higher incidence of injuries sustained by distance runners it is evident that these injuries are generally more debilitating and respond more slowly to treatment. Most of the 45 injuries which required treatment for longer than one week were sustained by distance runners.

The most common sites of injury were the hamstrings (12 strains), Achilles tendon (9 tendinitis) and tibia (7 stress fractures). In terms of severity, the knee region was the most seriously affected site with injuries to the knee joint structures accounting for all but one case in which competitive running was terminated. The lone exception was a severe case of Achilles tendinitis.

The results of this survey as shown in Tables VI, VII and VIII indicate that most injuries responded to forms of conservative treatment with rest and restricted activity being most frequently used. With the exception of meniscectomy, surgery produced poor results as a means of restoring injured runners to a competitive status. It is recommended that surgical correction should be considered only as a last resort for competitive runners.

Among various other conservative treatments of interest were the utilization of corrective inserts in shoes and instruction in proper running technique. The use of heel lift inserts to ease tension on the Achilles tendon has produced favorable results in a number of cases not included in this survey. It has been suggested recently by Sheehan[5] that corrective inserts can effectively alleviate symptoms of chondromalacia of the patella. We are unable to support or refute this notion of foot supports as a potential panacea for chondromalacia but recommend a thorough investigation of the mechanics of the entire lower extremity during the support phase before prescribing corrective inserts.

The correction of running gait was used sparingly but produced effective results in alleviating back pain in two cases. Gait correction presumes a thorough understanding of normal running gait and an appreciation of the extent to which a supposed "ideal" gait pattern may be influenced by structural factors. We have previously indicated precedent for changes in gait to

alleviate problems[3] and on another occasion we have pointed out that changes in gait may be incompatible with structural alignment and result in complications.[4] Before a decision is made to tamper with a runner's gait it would be well to consider the experience and expertise of the individual under consideration. It is unlikely that an elite runner would have progressed to his level of accomplishment with significant faulty technique. Great care should be exercised in recommending correction in such instances. However, gait correction may occasionally be indicated for less accomplished or novice runners. The most common fault evident in the gait patterns of inexperienced runners is overstriding. This can adversely affect the mobility of the lumbar spine-pelvic unit and contribute to inefficiency of running as well as the probability for injury.[6, 7]

SUMMARY

Injuries to one hundred and nine (109) runners seen in an orthopedic office were reviewed. Musculotendinous strains accounted for 33% of the total injuries. As a group, distance runners were the most frequently injured (41%), were generally more debilitated and responded the slowest to treatment. Rest and physical therapy were the most commonly used modes of treatment. Surgery was performed in only six cases. A thorough knowledge of running mechanics is extremely helpful in preventing and treating injuries to runners.

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EDITORIAL COMMENT

DR. JAMES A. NICHOLAS: The paper, "Injuries to Runners" illustrates the cooperative interrelationship between physical education, orthopedic surgery, and sports medicine. It is the first paper of its type that attempts to relate etiological, anatomic, and competitive factors to the injury problems of the runner.

The authors have compiled objective data which substantiate much of the theoretical work of Cureton,[1] Cerretelli,[2] and Hunsicker.[3] Running involves certain performance traits and "energetic processes". These "processes" are described by Cerretelli in terms of their exhaustive effect upon the participant. They are categorized as Type I, an activity which produces exhaustion within 20 seconds; Type II, exhaustion within 10 minutes; and Type III, exhaustion within 4 hours.

If these Types are equated with the sprint, middle distance, and distance events respectively, we can examine the injury distribution data presented in this paper and develop additional information—beyond what the others have modestly assumed.

Table I shows that strains occurred in 8 out of 10 runners competing in the sprint (Type I process); strains occurred in 2 out of 16 runners in the middle distance event (Type II); the same injury occurred in only 13 of 45 runners in the distance event (Type III). One can conclude from this that the explosive strength required of the sprinter is most apt to cause musculotendinous rupture. This fits well with Cerretelli's work.

Stress fractures, on the other hand, were shown to be more common in the middle distance event (Type II) and in the distance event (Type III). Thirty per cent of participants in the Type II event, suffered stress fracture and 16 per cent of those in Type III suffered the same injury. Stress fracture and tendinitis are thereby demonstrated to represent overuse syndromes. The same can be said for subluxation, chondromalacia, and osteochondral lesions. No sprinter sustained any of these injuries while approximately 20

per cent of the middle and distance runners had patellar lesions. It would appear therefore, that the repetitive processes with malalignment produced the patellar lesions.

Another interesting point raised by the authors is the fact that 10 of the total of 17 stress fractures occurred above the ankle. This indicates the foot to be stronger than one would expect. An exception is noted in Table III wherein 2 of the 5 middle distance (Type II) runners sustained stress fractures of the foot.

Many significant questions are raised in this paper which engender some worthwhile speculation. For example, why were the prime movers particularly more apt to have tendinitis (a frequency of 2:1 in favor of those muscles that run posterior to the mid-sagittal plane of the leg)? Moreover, 32 of the 47 strain and avulsion injuries (Table II) occurred in the calf, hamstrings, gastrocnemius, abductor and anterolateral muscles. Perhaps the explanation for this lies in gait or weaknesses. In view of the great variation in performance traits (eg, flexibility, strength, endurance, agility, coordination, balance) among runners, it would have been very interesting to find out what specific physical findings were noted that might have satisfied the theory that some runners are stronger than others because of differences in specific muscle strength or flexibility or becuase of other specific differences in body traits.

One can conclude, then, that there is a relationship between type of injury and type of activity and also between site of injury and specific components of the running mechanism. One might also state that the small bones of the foot did their job more efficiently than we were led to believe by the literature.

More studies such as this are needed to shed light on many related areas such as (1) the kinetic phase of running where muscle contraction runs from concentric, eccentric, ballistic and back to eccentric; (2) the effect of proximal limb strength or contracture of unrecognized origin; (3) methods for prophylaxis of such injuries which might come about through better somatotype analysis; (4) origin of stress fractures. (In most instances pain precedes physical evidence of stress fracture and might represent a strain long before it becomes a stress fracture. A better diagnostic technique is indicated in this regard; thermography has been suggested as one method.)

I compliment the authors on their paper and feel that their findings will help to resolve the current debate with respect to running injuries. The authors are also to be complimented for their cautious comparisons to the work of others (including Glick) by noting the difference in population samples used.

Comment References

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