# Orthopaedic trauma injuries in paralympic athletes

Roberto Vital[1], Hésojy Gley Pereira Vital da Silva[1], Ronnie Peterson Andrade de Sousa[1], Renata Bezerra do Nascimento[1], Edílson Alves Rocha[1], Henio Ferreira de Miranda[2], Maria Irany Knackfuss[3] and José Fernandes Filho[4]

**ABSTRACT**

In the last few years, the development of national and international games for the physically challenged has encouraged greater participation of athletes with physical disabilities. This resulted in an increase in intensity and frequency of the training routines and competitions and higher levels of trauma-orthopedic lesions. The aim of this descriptive-comparative study is to analyze statistically the incidence of trauma-orthopedic lesions of 82 physically challenged athletes selected in a non intentional and no probalistic way. These athletes belong to various sports categories, as follows: swimming = 37, table tennis = 19, athletics = 19, power lifting = 7. Sixty are males, 24, females, they range in age from 15 to 51 and they all took part in the 2002 World Championship. Applying the medical records of the Brazilian Paraolimpic Committee medical department filled in at those events (the technique of observing the athlete clinical-sports files and medical examinations), the result showed a recurrence of lesions in athletes in the following sports: athletics (MMII = 64.9%, backbone 19.3% and MMSS = 15.8%; power lifting (backbone = 54.5%, MMSS = 36.4% and MMII = 9.1%); swimming (MMSS = 44.4%, backbone = 38.9% and MMII = 16.7%) and table tennis (MMSS = 56%, Backbone = 36% and MMII = 8%). Such results lead to the conclusion that the performing of sports of the physically challenged athletes, and also the intensity of the training routing to try to beat their previous marks and results, cause these kinds of lesion. In addition, it is important to reinforce the preventive measures to the athletes.

**Keywords:** Trauma-orthopedic lesions. Athletes. Paraolimpic.

**INTRODUCTION**

The Para-Olympic movement which has appeared with the aim to improve rehabilitation as well as social insertion of individuals with disabilities, has recently reached acknowledgment from the population as an elite sport, with growing participation of the media, sponsors and audience, increasing thus the attention of professionals from several fields related with sports practice[1].

The structure of the Brazilian Para-Olympic sport is similar to the Olympic one; the main difference is related to the grouping of the athletes by disabilities and not by sports modalities.

The history of the Brazilian Para-Olympic Committee (CPB) is recent; yet, full of glory. It was created in 1995, from the natural growth of national associations, such as the Brazilian Association of Sports for the Visually Impaired (ABDC); the Brazilian Association of Para-Olympic Volleyball (ABVP); the Brazilian Association of Sports for the Wheelers (ABRADECAR); the Brazilian Association of Sports for the Mentally Challenged (ABDEM); the Brazilian Association of Sports for the Disabled (ANDE); the Brazilian Confederation of Basketball on Wheelchairs (CBBC); the Brazilian Confederation of Tennis (CBT) and the Brazilian Federation of Sail and Motor (FBVM), among others[2]. Such union enabled a growing achievement in the last three Para-Olympic Games with a total of 76 medals. Moreover, Brazil finished in the 37th position in Atlanta, with two gold, six silver and thirteen bronze medals. In the Sidney Games they were 6 gold, 10 silver and 6 bronze medals, with the team finishing in the 24th position. In Athens, it was in the 14th position, with 14 gold, 12 silver and 7 bronze medals, which demonstrates all the potential of these athletes. Considering these results over the last years, it can be observed that both national and international Para-Olympic sport have stimulated greater participation of individuals with disabilities in sports programs. Consequently, we have been facing an increase in individual and collective demands with the purpose to improve results as main objective to excel limits both physical and mental. Therefore, it is necessary to increase training and competition loads which cause the increase of trauma-orthopedic injuries in these athletes[3].

Osteo-tendomuscular injuries are the most frequent ones in sports practice[4-6]. The site of the injury varies according to the kind of sport practiced. Lower extremities are the most found sites by the most number of injuries since there is a close relationship between the most practiced sports by the general population and the sportive gestures such as jumping and sudden runs[7]. Around 90% of the sports injuries are located in the hip, thigh, knee, leg, ankle and foot[8]. In studies with 1,280 patients with sports trauma, 45% presented knee injury; 9.8% in the ankle; 7.7% in the shoulder. From these, around 53.9% involved only soft parts[9].

Sports injury, from the athlete's perspective, is the painful syndrome which hampers practice or impairs usual sports performance[10]. Sports injury is the name collectively used for all damage which occurs concerning sportive activities. The NAIRS (National Athletic Injury Registration System), in the USA, shows as reportable injuries those which limit the athlete's participation at least one day after the event which caused the injury. The NAIRS classifies injury according to the time of inability for sportive practice under low (1-7 days); moderately severe (8-21 days) and severe (above 21 days or with permanent injury). The European Committee defines injury as that incident which has as consequences (a) reduction in the amount or level of participation; (b) need of medium support or treatment; (c) adverse social and economical effects[11].

Statistical data concerning the Brazilian Para-Olympic athletes are scarce. We have been rescuing them after the implementation of medical records of the Brazilian Para-Olympic Medical Department since 1996 and through a data base from the CPB concerning national and international competitions (Para-Olympic Games; World Games and Pan-American Para-Olympic Games)[1,3].

Higher prevalence of trauma-orthopedic sports injuries in Para-Olympic athletes have been observed concerning several factors such as the higher number of disabled individuals practicing sports, higher number of sports offered, increase of opportunities in par-

1. Comitê Paraolímpico Brasileiro – Departamento Médico – Brasília, DF.
2. Universidade Federal do Rio Grande do Norte – Natal, RN.
3. LAFIS – Universidade Federal do Rio Grande do Norte – Natal, RN.
4. Universidade Castelo Branco – Rio de Janeiro, RJ.

Approved in 23/10/06.

**Correspondence to:** Roberto Vital, Rua Moura Rabelo, 1.904/601, Candelária – 59064-480 – Natal, RN. E-mail: rvital@ufrnet.br

ticipating in sportive activities, earlier start of sports practice, increase of intensity, duration and frequency of training and competitions.

Facing this scenario, we tried to analyze the prevalence of trauma-orthopedic injuries in Para-Olympic athletes participating in World Championships in distinct modalities in 2002, respecting the motor characteristic of each modality. As specific aims, we tried to identify the kind of disability according to the sports modalities which characterized the injured athletes; to verify the anatomic site of the most frequent intra-segment trauma-orthopedic injuries, and the most frequent kind of injuries in the Para-Olympic athletes in the different modalities.

## METHOD

The present study, of comparative descriptive characteristic, applied the comparison of the set of variables in the groups which determines that the differences cannot be randomly attributed.

### Sample

The sample was intentionally non-probabilistic composed of 60 male and 22 female (n = 82) athletes, age range of 15 and 51 years, who participated in the World Championships of 2002 in the following sport modalities: swimming = 37; table tennis = 19; track-and-field = 19 and weightlifting = 7. The research procedures were developed following the Research Regulations and Norms involving Humans from the Resolution 196/96 of the National Health Committee.

### Protocol

The athletes who participated in the Brazilian Para-Olympic team in track- and-field, weightlifting, swimming and table tennis modalities, in 2002, with motor-physical, visual and mental disabilities, were evaluated during medical and physiotherapeutic appointments. Such evaluation collected data of the clinic-sportive history of the athlete through an anamnesis (interview with the athletes) as well as a physical exam, using specific maneuvers in each body segment, within the medical semiology (Sheets/Medical and Physiotherapeutic protocol of the Medical department of the CPB) and complementary exams (X-rays, ultrasound, magnetic scans) of the trauma-orthopedic injuries, whenever necessary. The evaluations were performed in the pre-competition phases (trainings) and especially during competitions, trying to relate them with the Pre-Participation initial evaluation performed in all athletes. These data were registered in the medical records of the Brazilian Para-Olympic Committee (CPB).

The overlapping of injuries (defined for the study as being the kinds of different injuries and in several body segments) in the same athlete was included in the analysis and reoccurrences were excluded. The injuries diagnosed were divided in the following segments: spinal cord (cervical, thoracic or dorsum and lumbar), lower extremities (MMII) and upper extremities (MMSS), having their bone forming, ligament, articular and muscular structures included.

The trauma-orthopedic injury concerning sports practice considered was that which causes athlete's time out from his/her usual activities according to NAIRS criteria.

## RESULTS

Eighty-two (82) Para-Olympic athletes were evaluated, being 27 free-walkers (33%), 27 wheelers (33%), 12 walkers with a guiding cane (14.6%), 11 cane-walkers (13.4%), 2 walkers with a prosthesis (2.4%) and 3 orthoses cane walkers (3.6%). Fifty-nine were physically-motor (72%), 16 visually (19.5%) and 7 mentally disabled (8.5%). Thirty-seven were swimming (45.1%), 19 table tennis (23.2%), 19 track-and-field (23.2%) and 7 weightlifting (8.5%) athletes.

Concerning sex, sixty (60) were male (73.2%) and twenty-two (22) female (26.8%). Age group ranged from 15 to 51 years, being the mean between 21 and 29 years (with 38 athletes).

The mentioned sports, their modalities, categories and functional classifications are included in the IPC (International Para-Olympic Committee).

The most frequent injuries are summarized per segment in tables 1, 2 and 3.

**TABLE 1**
**Prevalence of most frequent intra-segment trauma-orthopedic injuries in the Para-Olympic athletes in the different modalities – World Championships, 2002**

| | Track-and-field | | Weight-lifting | | Swimming | | Table tennis | | Total | %total |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | | |
| Spinal cord | 11 | 19.3 | 6 | 54.5 | 28 | 38.9 | 9 | 36 | 54 | 32,7 |
| MMSS | 9 | 15.8 | 4 | 36.4 | 32 | 44.4 | 14 | 56 | 59 | 35,8 |
| MMII | 37 | 64.9 | 1 | 9.1 | 12 | 16.7 | 2 | 8 | 52 | 31,5 |
| Total | 57 | 100 | 11 | 100 | 72 | 100 | 25 | 100 | 165 | 100 |

**TABLE 2**
**Anatomic site of the most frequent intra-segmental trauma-orthopedic injuries in Para-Olympic athletes in the different modalities – World Championships, 2002**

| | Track-and-Field | | Weightlifting | | Swimming | | Table tennis | |
|---|---|---|---|---|---|---|---|---|
| | # injuries | % | # injuries | % | # injuries | % | # injuries | % |
| Cervical spine | 2 | 3.5 | – | – | 12 | 16.7 | 2 | 8 |
| Dorsal spine | 2 | 3.5 | 2 | 18.2 | 9 | 12.5 | 4 | 16 |
| Lumbar spine | 7 | 12.3 | 4 | **36.4** | 7 | 9.7 | 3 | 12 |
| Shoulder | 8 | 14.1 | 2 | 18.2 | 21 | **29.2** | 8 | **32** |
| Arm | – | – | – | – | 3 | 4.1 | 1 | 4 |
| Elbow | – | – | 2 | 18.2 | 5 | 6.9 | 3 | 12 |
| Forearm | – | – | – | – | – | – | 2 | 8 |
| Wrist | – | – | – | – | 2 | 2.8 | – | – |
| Hand | 1 | 1.7 | – | – | 1 | 1.4 | – | – |
| Thigh | 5 | 8.8 | – | – | 2 | 2.8 | 1 | 4 |
| Knee | 7 | 12.3 | – | – | 5 | 6.9 | 1 | 4 |
| Leg | 22 | **38.6** | – | – | 2 | 2.8 | – | – |
| Ankle | 1 | 1.7 | – | – | 1 | 1.4 | – | – |
| Foot | 2 | 3.5 | 1 | 9 | 2 | 2.8 | – | – |
| Total | 57 | 100 | 11 | 100 | 72 | 100 | 25 | 100 |

**TABLE 3**
**Types of most frequent intra-segmental trauma-orthopedic injuries in Para-Olympic athletes in the different modalities – World Championship, 2002**

| | Track-and-field | | Weight-lifting | | Swimming | | Table tennis | | Total | %total |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | | |
| Spinal cord algias | 11 | 19.4 | 6 | 54.5 | 28 | 38.9 | 9 | 36 | 54 | 32.7 |
| Concussions | 3 | 5.3 | 1 | 9.1 | 8 | 11.1 | 3 | 12 | 15 | 9.1 |
| Tendinitis | 27 | 47.4 | 2 | 18.2 | 23 | 31.9 | 9 | 36 | 61 | 37 |
| Fasciitis | 1 | 1.7 | – | – | – | – | – | – | 1 | 0.6 |
| Epicondylitis | – | – | 2 | 18.2 | 4 | 5.5 | 3 | 12 | 9 | 5.5 |
| Strain | 13 | 22.8 | – | – | 6 | 8.4 | 1 | 4 | 20 | 12.1 |
| Sprain | 1 | 1.7 | – | – | 3 | 4.2 | – | – | 4 | 2.4 |
| Metatarsalgia | 1 | 1.7 | – | – | – | – | – | – | 1 | 0.6 |
| Total | 57 | 100 | 11 | 100 | 72 | 100 | 25 | 100 | 165 | 100 |

Considering the few articles published in the international and especially in the national literatures, about the incidence of trauma-orthopedic sports injuries in Para-Olympic athletes, we tried through this study to statistically raise and compare them with the data published concerning the injuries occurred in Olympic athletes.

A predominance of muscular-tendon injuries was found in the data collected during the World Championship of Para-Olympic track-and-field. Among the segmental injuries, the Para-Olympic athletes presented higher incidence in the MMII, with 64.9% of the injuries, especially legs, with 38.6% of the cases.

From the data collected during the weightlifting World Championship, great incidence of spinal cord injuries can be observed – around 54.6% – being the lumbar spine the one which presents greater attention with 36.4% of the cases. The MMSS presented a frequency of injury of 36.4%.

In table tennis Para-Olympic athletes a predominance of shoulder injuries was observed with 32% and in the spine cord with 36%.

## DISCUSSION

According to the widely accepted multifactor model of causes of muscular injuries, the application of protection and prevention measurements specific to these disabled and with special needs athletes is crucial[5]. Both macro and micro-traumas have greater possibility of occurrence in these athletes when intrinsic factors such as strength compromising, balance, marching, coordination, sensibility, tonus, flexibility and anatomic aligning are present; many times leading to an overuse of the segments not functionally affected, autonomic hyperflexion, thermoregulation dysfunction, besides extrinsic factors such as use of wheelchair, orthoses, prostheses, inadequate site for sports practice, irregular training type[6-7]. These athletes, should be individually observed and cared, considering their disabilities, additional abilities and sports modality practiced.

Within this broader view of the results, one may observe that the Para-Olympic track-and-field is characterized by the lack of physical contact among competitors. However, this modality is marked by a diversity of competitions with cyclic and acyclic movements (besides a large number of asymmetric movements), which directly influences over the athletes' biomechanics, which favors the occurrence of a high number of injuries not only attributed to these distinct characteristics of the sport itself, but also influenced by the peculiarities of the Para-Olympic sport, such as the use of orthoses and prostheses.

The literature shows that from the sports injuries in track-and-field most evidenced in Olympic athletes, 17 to 76% are musculoskeletal, 20% of them occurred during competitions[5,9,12]. No reference was found concerning Para-Olympic athletes injuries in this modality.

Among the varied structures of MMII, we highlight in the Para-Olympic athletes the injuries in the leg, which corroborates the results mentioned by Bennell *et al.* (1996)[12], who report in their work with 95 Olympic athletes, an incidence of 27.7% of injuries in the leg, followed by thigh (21.5%), knee (16.2%), foot (14.6%), ankle (7.3%), dorso/pelvis and hip (13%). However, Laurino *et al.* (2000)[13] have demonstrate a different reality, once in their work the injuries in the thigh were the body segment which obtained the highest incidence with 53,3% of the cases, followed by knee with 17.5%, MMSS and chest, with 11.7%, ankle and foot with 9.1% and leg with 8.3%.

When the results presented by the Para-Olympic weightlifting were compared, we verified a great similarity with the studies by Goertzen *et al.* (1989)[14], when considering the great majority of injuries related with Olympic weightlifting in musculo-tendon injuries, with an incidence of 83.6%, being the injuries involving the lumbar spine and MMSS the most frequent.

In swimming, a sport which has been practiced by a growing number of individuals, especially young Para-athletes, great incidence of shoulder injury has been a remarkable point. It has been even considered by many authors as an orthopedic condition common to swimmers, affecting around 60% of the athletes[15-17]. Through the results here analyzed, a similarity with the results found by Richardson *et al.* 1980)[17] and Cohen *et al.* (1998)[16] was observed, after they have evaluated a group of 137 and 205 Olympic swimmers respectively, evidencing a injury history of 63.5% in the shoulder, followed by the lumbar spine, the knee, the elbow and other joints cases. When other anatomic structures are referred, the data are similar for both Olympic and Para-Olympic athletes, with emphasis for spinal cord, knee and elbow injuries.

It was verified that injuries related with Para-Olympic table tennis, may be divided in acute and chronic, where the more prevalent are the epicondylitis, since the athletes who composed the sample were in their majority users of wheelchairs. It became evident hence, that the use of a wheelchair favors the risk for additional injuries, added to the training and competitions as factors which lead to some time away from sports activities. The investigations in the specialized literature show similar results concerning injuries faced by the Para-Olympic athletes in this modality[18].

The outcomes here presented may be extrapolated only for elite Para-Olympic athletes.

## CONCLUSIONS

It was found in this study that musculo-tendon injuries are the most common in the Para-Olympic sport with most frequent occurrence in track-and-field in the lower extremities (64.9%), weightlifting in the spinal cord (54.5%), table tennis and swimming in the upper extremities (56% and 44.4%, respectively).

High incidence of injuries was observed with the results obtained, being a better follow-up and standardization of evaluations and procedures for them needed yet. Further studies which identify at which moment during training and/or competitions of each modality the injuries occur should be carried out. In addition to that, the relationship between the prevalence of injuries and the classification of athletes in competitions is needed.

*All the authors declared there is not any potential conflict of interests regarding this article.*

## REFERENCES

1. Silva AC. Atleta portador de deficiências. In: Ghorayeb N, Neto TLB. O exercício. Preparação fisiológica – Avaliação médica – Aspectos especiais e preventivos. São Paulo: Atheneu; 1999.
2. Martins da Costa A. Trabalho de resultados. 2004; Revista Brasil Paraolímpico; 8(14):17.
3. Vital R, Silva Hesojy GPV. As lesões traumato-ortopédicas. In: Mello MT, editor. Avaliação clínica e da aptidão física dos atletas paraolímpicos brasileiros: conceitos, métodos e resultados. São Paulo: Atheneu; 2004.
4. Lasmar NP, Camanho GL, Lasmar RCP. Medicina do esporte. Patologia tendinosa na atividade esportiva. Revinter, 2002. p. 13-182.
5. Cohen M, Abdalla RJ. Lesões no esporte. Diagnóstico, prevenção e tratamento. Lesões musculares. Revinter, 2003;42:615.
6. Tietz CC. Patellofemoral pain in dancers. J Operd. 1987;May/Jun:34-6.
7. Garrick JG, Requa RK. The epidemiology of foot and ankle injuries in sports. Clin Sports Med. 1988;14:218-24.
8. Leadbetter WB. In: Fu F, Stone D, editors. Soft tissue athletic injury. Sports injuries. Baltimore: Wiliams & Wilkins; 1994. p. 733-80.
9. Whitman PA, Melvin M, Nicholas JA. Common problems seen in a metropolitan sports injury clinic. Phys Sportsmed. 1981;9:105-10.
10. Schenck RC Jr. Lesões esportivas e a resposta dos tecidos à lesão física. Medicina Esportiva e Treinamento Atlético, 2003. p. 128.
11. Lasmar NP, Camanho GL, Lasmar RCP. Medicina do esporte. Reabilitação na atividade esportiva. Revinter, 2002. p. 22-424.

12. Bennell, et al. (1996). Atletismo. In: Cohen M, Abdalla RJ, editors. Lesões no esporte. Diagnóstico, prevenção e tratamento. Revinter, 2003. p. 688-713.

13. Laurino CFS, Lopes AD, Mano KS, Cohen M, Abdalla RJ. Lesões músculo-esqueléticas no atletismo. Rev Bras Ortop. 2000;35:364-8.

14. Goertzen M, Schoppe K, Lange G, Schulitz KP. Injuries and damage caused by excess stress in body building and power lifting. Sportverletz Sportschaden. 1989;3(1):32-6.

15. Johnson JE, Sim FH, Scott SG. Musculoskeletal injuries in competitive swimmers. Mayo Clin Proc. 1987;62(4):289-304 [Review].

16. Cohen M, Abdalla RJ. Lesões no esporte. Diagnóstico, prevenção e tratamento. Natação. Esportes aquáticos. Revinter 2003;60:819.

17. Richardson AB, Jobe FW, Collins HR. The shoulder in competitive swimming. Am J Sports Med. 1980;8(3):159-63.

18. Pintore E, Maffulli N. Osteochondritis dissecans of the lateral humeral condyle in a table tennis player. Med Sci Sports Exerc. 1991;23(8):889-91.