

## Research Article

# Sports and Physical Activities in Haemophiliacs: Results of a Clinical Study and Proposal for a New Classification

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Submitted: 04 August 2016

Accepted: 29 August 2016

Published: 30 August 2016

ISSN: 2333-6684

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## Keywords

- Haemophilia
- Sports
- Physical activities
- Haemorrhagic disease

## Abstract

Sports and physical activities have long been contraindicated for haemophiliacs, or they were restricted to a few activities such as swimming or walking. Recent progress in therapy has meant that haemophiliacs are now encouraged to participate in sports, although various guidelines have recommended that they avoid activities where risks outweigh benefits. In order to evaluate the type of sports undertaken by haemophiliacs and the benefits or risks associated with each sport, we conducted a questionnaire-based study. The questionnaire was sent to 124 patients. Among the 80 patients who responded, 71 (90%) currently participated in or had previously participated in a physical activity. Among them, 56 (70%) still played a sport. Nearly all sports were cited in the answers, the most frequently played by these 56 haemophiliacs being swimming (59%), cycling (44%), walking (43%), table tennis (33%), soccer (33%) and tennis (31%). Fifty-six patients reported a benefit in doing a sport: somatic (79%), psychological (80%) or social (62%). Thirty haemophiliacs (42%) reported at least one accident or incident linked to sport. From these data and the literature, we propose a new functional classification based on the type of movement and gestures involved in the sport. This classification distinguishes eight types of sports: aquatic sports, sports involving walking or running, static sports, sports involving a gliding movement, sports with a ball, team sports, throwing or jumping, and combat sports. Recommendations adapted for haemophiliacs can be drawn from this classification, which now requires validation in larger series.

## INTRODUCTION

Haemophiliacs or haemophiliacs' parents often ask about the advisability of participating in a sport. Medical answers have varied over time [1-3]. Until 1970, physical sports were contraindicated [1]. Nowadays answers continue to vary from one country to another or from one physician to another, even within a single centre. The reason is that while everyone recognizes the numerous benefits of sport, a certain fear, mainly related to the risk of haemorrhage, leads to contraindicating most physical activities. Various recommendations have been proposed [4-6]. Since 1990, the tendency in the literature has been to classify sports into different categories. These classifications were proposed by scientific societies, individual authors or patient support groups [4,5,7-15]. They established three or four categories of sports: some sports were recommended, others were authorized with restrictions, while others were not recommended or contraindicated. All these classifications were based on the haemorrhagic risk associated with these physical activities. So they generally relied on common sense but

frequently derived from a cloudy perception of particular sports. Moreover, they did not include the main problem encountered by haemophiliacs in their choice of sport, namely the patient's orthopaedic status. Today clinical studies evaluating which sports can be undertaken by haemophiliacs and the physical, social or psychological consequences of this activity are rare.

Therefore we decided to conduct a clinical study among patients followed in our Haemophilia Treatment Centre (HTC). The aim of the study was to evaluate all the sports that were played or had been played by a haemophiliac population in the same study; we investigated the difficulties encountered, the benefits and the incidents or accidents. We conclude by proposing a new functional classification based on the type of movement made by the haemophiliac during physical activities and the involvement of the main articulations during this sport.

## PATIENTS, MATERIAL AND METHODS

## Patients

Inclusion criteria: patients >6 year-old followed in Montpellier

Haemophilia Treatment Centre (HTC) for congenital haemophilia A (Factor VIII < 40%) or B (factor IX < 40%). Patients with inhibitors could also be included. Type III Willebrand disease could also be included.

Exclusion criteria: Patients with acquired haemophilia; patients with another associated haemorrhagic disease (i.e. haemophilia associated with thrombocytopenia, haemophilia with disease of the liver or other conditions leading to acquired coagulation deficiency); patients with severe handicap.

## Methods

All the patients who met the inclusion criteria received a questionnaire approved by the Ethical Committee of Montpellier Academic Hospital. They were asked to give back the questionnaire at their next consultation in HTC. Two patients were excluded due to severe handicap. Finally, questionnaires were sent or given to 124 patients. They all accepted that after anonymization, their answers could be used for a scientific work.

Finally, 80 patients participated to the study representing 65% of the patients who received the questionnaire.

Sixty-eight patients had haemophilia A: 20 of them had severe haemophilia A (FVIII < 1%), 18 were moderate (1% < F VIII < 5%) and 30 were mild (5% < F VIII < 40%); nine had haemophilia B: 2 severe, 2 moderate and 5 mild. None of them had inhibitor. Three patients had type III Willebrand disease. The median age was 33 years (range 6–80). Thirteen patients were less than 14 years old, 25 were in the range 14–33, 30 were 34–55 years old and 10 were over 55 years.

## Questionnaire

Data concerning the medical status of the patients were collected in the medical file and during the consultation. The questionnaire was organized as follow: sport practice: Yes/ No. Those who never had physical activity were asked for a reason: lack of interest for sports or medical contraindication. The questions for those who had a physical activity or still practiced were divided into subgroups:

- General conditions: type of sport played in the past or currently played; the age when the sport was begun; the reason why sport activity was stopped if this was the case;

- consequences: incidents or accidents related to physical activities; patients were encouraged to give a general impression of their experience doing sport with the possibility of giving open answers on physical, psychological or social benefits;

- A group of questions concerned the attitude of their doctors on sport activity;

Then, during the consultation the authors tried to analyse with the patients the exact conditions where an incident or accident occurred. The interest was to better analyse the type of motion leading to this situation thus going through the sport to understand which motion has to be avoided. This analyse allowed to propose a specific classification.

## RESULTS

### Haemophilia-related status

Severity of the arthropathy: Among the 80 patients, 54 had at least one joint severely damaged: 2 were <14 yrs., 15 had 14 to 33

yrs., 27 had 34 to 55 yrs. and 10 had > 56 yrs.

Forty three patients had 2 or more joints impairments. Main localization of arthropathy was knee (64%), ankle (38%) and elbow (31%).

Comorbidities were mainly hepatitis C (14%), hepatitis B (5%) and VIH (2%)

Replacement therapy by factor VIII or IX was different according to the severity of the disease and the age. The 5 children (<14yrs) with severe haemophilia and 1 with moderate disease were on prophylaxis. Among the 55 patients between 14yrs and 54 yrs., 9 were under prophylaxis, 46 were on-demand. Two patients aged > 56 were on prophylaxis.

### Participation to sports

Among the 80 patients, 56 (70%) had participated in sport: 44 had a regular sport activity, 11 competed. Among the 24 patients who had no sport activity, 15 had previously participated in a sport. Only eight (10%) had never done sport. Finally, 71 of the 80 patients (90%) participated in or had participated in sport. Severity of the disease was not critical: among the 42 who had severe haemophilia, 29 had a physical activity (69%), while 27 (71%) of the moderate or mild haemophiliacs had a physical activity.

Twenty-four haemophiliacs (30%) did not do sport. The main reasons were medical contraindication ( $n=16$ ), or personal reasons ( $n=18$ ): lack of interest in sport, lack of time and other hobbies. The lack of physical activity was not linked to severity of the disease: 13 were severe haemophiliacs, 11 were mild or moderate.

Nearly all sports were cited: five sports were done by at least 30% of patients: swimming (59%), cycling (44%), walking (43%), table tennis (33%), soccer (33%) and tennis (31%). Other sports were done by 10–30% of patients: bowls, skiing, jogging, canoeing, gymnastics, sailing, athletics, volleyball, body building, and scuba diving. Other sports cited are listed in Table (1).

Seven (13%) patients who did sport were under regular prophylaxis, 37 (66%) had an on-demand regimen and did not modify their treatment to take part in sport, while nine (16%) had on-demand treatment but made an infusion of ant haemophilic factor before sport.

### Incidents and Accidents

Among the 71 haemophiliacs who currently have a physical activity or had a physical activity in the past, 30 (42%) had had at least one accident or incident linked to sport: 17 occurred in the 35 severe haemophiliacs, while 13 occurred among 36 who had moderate or mild disease. Thirty-nine (55%) never had a problem. Two patients did not answer the question. The sports that generated adverse effects were soccer ( $n=9$ : four haemarthroses), cycling ( $n=8$ : four haemarthroses; mainly mountain biking), basketball, tennis, gymnastics and horse riding. Obviously, the number of accidents or incidents was dependent on the number of patients involved in a sport. We thus evaluated the percentage of accidents or incidents in relation to the number of participants. The results are shown on Figure

(1). For snowboarding, motocross, figure skating and rugby, the 100% values reflect individual experiences (one patient in each case).

### Benefits estimated by the patients

Fifty-six patients (79%) estimated they had a somatic benefit from physical activities: development of musculature (28%), better physical performance (23%), reduction of haemarthrosis frequency (11%) and improvement of articular problems (11%). Psychological benefit was experienced by 57 patients (80%). Due to the type of questionnaire (open answers), benefits were appreciated in various ways, but the most frequent answers

involved feelings of well-being (23%), feelings of being identical to others (15%), development of team spirit (11%), a sensation of surpassing themselves (11%), development of a desire to win (8%) and self-esteem (5%). Concurrently, 44 patients (71%) found a social benefit: better social integration (28%), expansion of the relational network (14%), improvements in relations with family and friends (8%) and feelings of participating in a collective project (5%).

### Difficulties and problems encountered

Twenty-six patients (37%) reported difficulties when doing sport: the most frequent difficulties were encountered in sport clubs or at school ( $n=17$ : 28%): reluctance in the club, sometimes leading the patient to hide his haemophilia, refusal from teachers or coaches ("you can stay but only watch"), rejection by partners, fear of others' opinion because of the handicap, unsuitable material, problems due to recurrent haematomas or difficulties in following the training program. Ten patients (14%) had difficulties with their doctor or the medical staff: unwilling doctors, refusal to give medical certificate authorising sport and contraindications to the sport they wanted to play. The attitude of patients' doctors concerning sports is represented on Figure (2). More than 50% of doctors were favourable to sport for their patient. Finally, problems or difficulties within the family were less frequent:  $n=7$  (10%). Again, patients reported unwillingness and fear of parents or relatives concerning certain sports considered as dangerous.

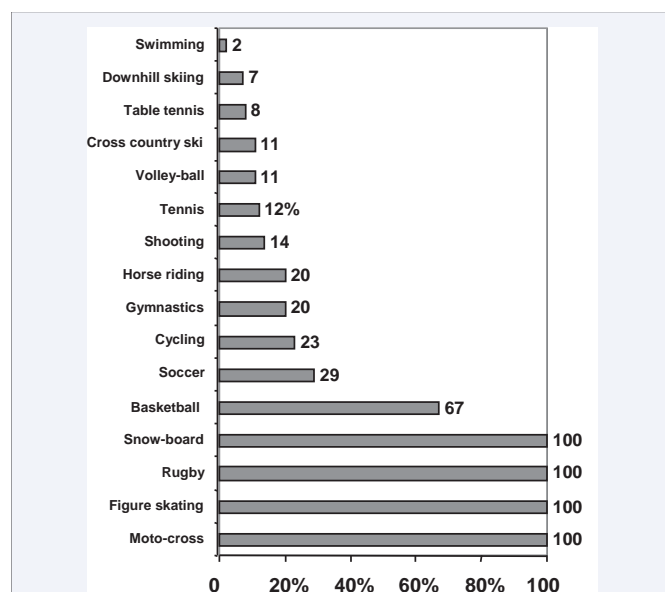
### DISCUSSION

In the present study, 70% of haemophiliacs who completed the questionnaire have or have had a physical activity, in agreement with other series in the literature: 74% for Glomstein et al. [16], and 74% for Heijnen et al. [15]. However, we must consider the potential bias of our study: we did not include two patients with severe handicap because the questionnaire seemed inappropriate for them. We included three severe Willebrand disease patients. They had a factor VIII level less than 10%. In the results, we included them in the mild or moderate haemophiliac group. They were the only three females in the study, but the sports played were not different from other patients. Another bias concerns the age of patients: the median age in the present series was 33, which is rather low. Many French haemophiliacs have died as a result of HIV contamination. The proportions of haemophilia A versus B and of severe haemophiliacs as compared to moderate or mild were identical in patients included and in the overall population that received the questionnaire. To compare with the French population of haemophiliacs, we can use the French registry of haemophiliacs – France Coag (<http://www.francecoag.org>) – which included more than 4000 patients. In this registry, severe haemophiliacs represent 54% of the patients included, nearly identical to our series (53%).

The type of sports played is also influenced by family environment and national culture. Soccer is the most popular sport in France and, like cycling, is highly accessible. Thus these sports are the most frequently found in our haemophiliacs' physical activities. This problem has been pointed out in other publications [15]. On the other hand, American football, baseball, cricket or golf are rare sports in France. In a series published in

**Table 1:** Type of sports that are played and have been played by haemophiliacs.

Sports frequently cited No. of patients (percentage)	Sports less frequently cited	Other sports
	No. of patients (percentage)	
Swimming: 47 (59%)	Bowls: 25 (31%)	Handball, sledging
Cycling: 35 (44%)	Skiing: 14 (18%)	Shooting, golf
Walking: 34 (43%)	Jogging: 12 (15%)	Archery, climbing
Table tennis: 26 (33%)	Canoeing: 10 (13%)	Horse riding
Soccer: 26 (33%)	Gymnastics: 10 (13%)	Judo, windsurfing
Tennis: 25 (31%)	Sailing: 10 (13%)	Caving, Basketball
	Athletics: 9 (11%)	Badminton, rowing
	Volleyball: 9 (11%)	Canyoning, karting
snowboarding	Body building: 9 (11%)	Surfing
jumping	Scuba diving: 8 (10%)	Water polo, bungee
skating		Rugby, roller/inline
		Figure skating, Motocross



**Figure 1** Percentage of accidents or incidents compared to the number of participants.

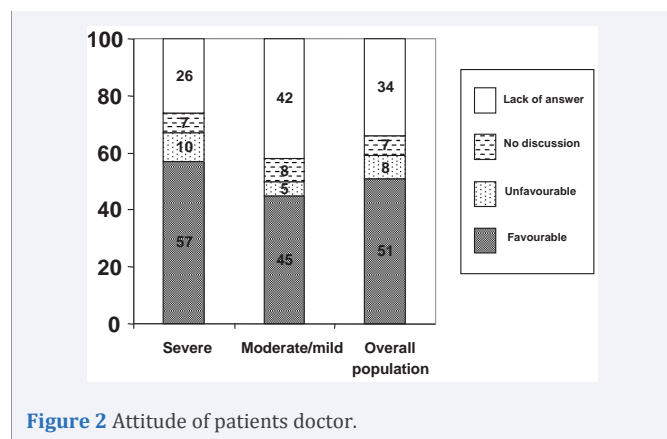


Figure 2 Attitude of patients' doctor.

1994, Glomstein [16] only evaluated the sports played during the winter by Norwegian haemophiliacs. The Dutch series published in 1996 [17] reported 32 sports played but only mentioned swimming, fitness, table tennis, cycling, badminton and tennis. In 2000 the same author [15] reported a series of 293 haemophiliacs: the most frequently played sports were swimming, cycling and tennis, while soccer was less frequently found. It is obvious that for one sport, incident and accident frequency rises with the number of haemophiliacs that do this sport. Consequently an accurate evaluation of sport problems must take into account the number of patients who participate in this sport; a more precise evaluation would be an index of the number of accidents or incidents per patient and per year of sport activity. Such an index does not exist in the literature and would require a large series of patients to construct. Nevertheless, the incident or accident reported herein in patients who tried dangerous sports such as motocross or rugby show that with a low number of patients, clinical evidence would quickly join common sense. Yet common sense cannot be the only criterion on which to base recommendations: they must rely both on individual criteria, mainly the orthopaedic status of the patient, the characteristics of the patient's haemophilia, the type of treatment, and be based on a precise study of the activity and gestures involved in the sport. Since 1970, the recommendations on sports have evolved from substantial restrictions or contraindication toward an evaluation of a risk-benefit ratio for each sport. Buzzard & Jones [9] considered that while some sports have to be considered as too risky for haemophiliacs, an individual approach was necessary before taking a decision. They also encouraged the participation of a physiotherapist to provide a specific preparation for each sport. Following this idea, McLain & Heldrich [10] proposed a multidisciplinary approach aiming to encourage some sports rather than forbidding others. In 1991, De Mondenard [18] proposed a classification of sports into three categories: sports recommended sports where the authorisation has to be evaluated according to orthopaedic status and sports considered as unsuitable for haemophiliacs. This classification was further modified by its author [11]. In 1992, the World Federation of Haemophilia (WFH), after sending a questionnaire to all physicians involved in haemophilia care, proposed a ranked list of 69 sports, finally classified into three categories. The most highly recommended was swimming, the least was boxing. This classification was then modified by WFH [5] in a brochure that

included 77 sports. The WFH classification has the advantage of being exhaustive. However, it defines an intermediate category of 54 sports without clear recommendations. Other recommendations were given by the National Hemophilia Foundation and the American Red Cross [4,19]. Again, sports were classified into three categories: sports recommended sports for which benefits for haemophiliacs exceed risks and dangerous sports where risks outweigh benefits. In 2001, the American Society of Paediatrics gave a classification of sports according to static and dynamic criteria [20]. It has been completed by a classification of sports by risk of trauma applied to haemophiliacs [7]. However, haemophiliacs still have difficulties in playing sports. In a study published in 2001, Shoenmakers et al. [21], reported that 56% of haemophiliacs were faced with restrictions in sports or gymnastics. Interestingly, their study found that children with restrictions in sports or who had pain had a higher chance of experiencing disease impact, compared to those who did not have restrictions in sports or experience pain.

### Toward a Practical Attitude and a New Classification

From our study and the data in the literature, we have attempted to propose a new approach for the physician faced with the problem of sport activities in haemophiliacs. Two critical points must be studied: first the haemorrhagic risk mainly due to sport-induced trauma. This risk is obviously directly related to disease severity, but the precise analysis of motions led to emphasize some conditions linked to each physical activity mainly traumas and stress on the joint. The risk of trauma involves collisions between players (rugby, American football), punches or kicks (contact sports), but also repeated trauma on the joints (soccer). We call joint stress a violent movement involving abrupt force on the articulations (throwing discus, javelin, hammer, and jump). The second point is orthopaedic risk, which depends on orthopaedic status. For instance, the ability to partake in skiing is much more determined by ankle and knee integrity than by haemophilia severity. Thus, the first step should be an initial check-up focusing on the type and frequency of hemorrhagic symptoms, osteoarticular status and type of treatment: prophylaxis, on-demand and presence or absence of an inhibitor. Then the choice of sport will depend on the wishes of the patient, motivation, and on this check-up. In this way, a level of risk for each haemophiliac can be evaluated and a level of risk can be established for each sport, or within each sport for each type of activity. Of course one has to take into account a difference between occasional, regular activity and competition.

The choice of sport could be helped by a functional classification that considers the movement required for each physical activity, the conditions of these activities, and the consequences for each articulation. This classification, summarised in Table (2), called the Montpellier Haemophilia Sport Classification (MHSC), was established in collaboration with doctors specialised in sport medicine, physiotherapists and in some cases with sport coaches. It distinguishes eight types of sports: aquatic sports, sports involving walking or running, static sports, sports involving gliding movement, sports with a ball, team sports, throwing or jumping, and combat sports.

Aquatic sports include swimming, snorkelling and water polo. They can be done with no restrictions. Diving is possible,

**Table 2:** The Montpellier Haemophilia Sport Classification (MHSC).

Group of sports	Sports included
Aquatic sports	Swimming, snorkelling, water polo, scuba diving
Sports involving walking/running	Walking, snow shoeing, golf, jogging, middle distance running
Static sports	Archery, Tai Chi, shooting, horse riding, climbing, caving, road cycling, bowls or bowling, weightlifting
Sports involving gliding movement	
on water	Sailing, surfing, windsurfing, canoeing, rafting and rowing
on sand	Sand boarding, sand yachting
on snow or ice	Skiing, sledging, snowmobiling, Curling, ice skating.
on the ground	Roller/inline skating, skateboarding
Sports with a ball	Table tennis, badminton, squash, racket ball, tennis, cricket, softball, baseball (+ fencing)
Team sports	
Contact sports	Volleyball, beach volleyball, basketball, handball, soccer
Collision sports	Hockey, rugby, American football
Throwing or jumping	Throwing discus, javelin, hammer, shot put, high jump, long jump, pole vaulting, triple jump, figure skating
Combat sports	Judo, aikido, tae-kwon-do, jiu-jitsu, boxing, Thai boxing, wrestling, kick boxing, karate

but high diving belongs to the throwing or jumping category. Haemophilia is considered only as a relative contraindication to scuba diving by the Professional Association of Diving Instructors (PADI), leading to an individual decision taken by a specialist in hyperbaric medicine. We have now a large experiment about haemophilia and scuba diving that was published in 2012 [22].

Sports involving walking or running include walking, snow shoeing, golf, jogging, and middle distance running. It excludes cross-country running and hurdles, which are much more closely related to jumping or throwing. In this group, some restrictions may come from the osteo-articular status of the lower limbs and from the surface on which the sport is done: road running may induce micro-traumas. The choice of adequate shoes is important.

Static sports include archery, tai chi, shooting, horse riding, rock climbing, caving, road cycling, bowls or bowling and weightlifting (without competition). In this group, the sport activity mainly depends on upper limb articulations. While the benefits of this group of sports seem evident, one could be hesitant with rock climbing for haemophiliacs. Again the opinion of the professional is important: rock climbing with appropriate material and qualified managers is not more dangerous for haemophiliacs than for normal individuals. It only requires specific training and strict observance of safety rules.

Sports involving a gliding movement induce a different risk for the most part associated with the surface on which they are played. Three smooth surfaces do not cause major problems: water, snow and sand. Sports on water include sailing, surfing and windsurfing, canoeing, rafting and rowing. Sports on sand include sand boarding and sand-yachting. Sports on snow or ice

include skiing, sledging, snowmobiling, curling and ice skating. Figure skating belongs to the jumping or throwing group. For these sports involving a gliding movement, the risk of trauma is low except in certain conditions: trauma against rocks in the water or in snow and trauma due to the mast in a boat. In some circumstances, high speed transforms a smooth surface into a rough surface: this is true for water (water skiing), snow (downhill skiing), or ice (speed skating). Sports on the ground include roller and inline skating and skateboarding. They expose the participant to an unacceptable risk of trauma, even when they are done with appropriate protection.

Sports with a ball include table tennis, badminton, squash, racket ball, tennis, cricket, softball and baseball. These sports, all asymmetric, are possible only if the subject has no lower limb arthropathy. Risk of hemarthrosis is high, so they require good and regular training and might be reserved preferably for patients under prophylaxis. Fencing raises the same problems.

Team sports include volleyball, beach volleyball, basketball, handball, soccer, floor hockey, field hockey, ice hockey, rugby and American football. They expose the player to physical contact. However, collision sports have to be distinguished from contact sports [23]: collision sports are played with the intent of striking opposing athletes. Sports in this category include hockey, American football and rugby. In contact sports, physical contact with other athletes is possible but is not intended. Contact sports include volleyball (contact with teammates is frequent), basketball, handball and soccer. Collision sports cannot be recommended. In European countries, the question of contact sports, mainly soccer, is frequently asked. Severe restrictions do not seem appropriate. Currently, for all of these sports, the decision is individual, depending on osteo-articular status and on the type of treatment. Most of these sports can be played by moderate haemophiliacs, possibly after DDAVP infusion [24]. For severe haemophiliacs, prophylactic treatment gives greater safety for these sports [25]

The throwing or jumping group includes throwing discus, javelin, hammer, shot put, high jump, long jump, pole vaulting, and triple jump, high diving and figure skating. This group of sports is characterised by violent movement involving abrupt force on the articulations. For throwing, the resistance to movement is proportional to the weight thrown. Jumping in all forms adds a risk on the take-off foot and on landing. This group of sports is not recommended for haemophiliacs. Even with good training and prophylaxis, it exposes the athlete to an unacceptable risk of articular complications.

Combat sports include judo, aikido, tae-kwon-do, jiu-jitsu, wrestling, boxing, Thai boxing, kick boxing and karate. The risk of trauma is major. These sports cannot be recommended, even for patients under prophylaxis. However, within each of these sports some activities may be undertaken without danger: training without fighting, katas in judo, jiu-jitsu or karate. It has been shown that resistance training not only increases muscle strength [26], but also decreases the frequency and severity of bleeding episodes and the associated pain [27-29].

Severe restrictions to sports in the haemophilic population are nowadays obsolete. Risk-taking activities selected by

haemophiliacs tend to be adaptive for the limitations imposed by their illness [30]. It is important that haemophiliacs who want to participate in one of these sports train regularly, respect sufficient warm-up times, use adapted material and get adequate training. Current recommendations on the type of sports that can be done rely a great deal more on common sense, fear and individual experience than on a scientific approach or clinical studies. Such studies evaluating the true risks and objective benefits are needed.

## ACKNOWLEDGEMENTS

We thank Michèle Ibanez and Jackie Carabasse for excellent technical assistance. We also want to thank the subjects and their families for their cooperation.

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### Cite this article

Schved JF (2016) Sports and Physical Activities in Haemophiliacs: Results of a Clinical Study and Proposal for a New Classification. *J Hematol Transfus* 4(3): 1050.