



Abnormal inter-extremity difference (AIED) of quadriceps muscle strength and relationship to patellar tendon thickness and joint status in PWH

Brunner A, Hoffmeister M, Stäuber F, Göhler S, Czepa D, Stephan H, Hilberg T

Department of Sports Medicine, University of Wuppertal, Wuppertal, Germany

Introduction:

One significant complication of haemophilia are intra-articular bleedings with a frequent exposition of the lower limb joints. Long-term repeated joint bleedings lead to haemophilic arthropathy, which is characterized by chronic proliferative synovitis and cartilage destruction [1]. In some cases recurrent intra-articular haemorrhages occur predominantly unilateral resulting in a considerable joint destruction on the affected side with detrimental consequences for strength symmetry of the lower extremities. In this context an asymmetry of muscular strength greater than 20% has been described as almost certainly abnormal [2]. Results of an earlier own study indicated a high prevalence of such a strength specific abnormal inter-extremity difference (AIED) in persons with haemophilia (PWH) [3]. It has to be assumed that an AIED has direct implications for the related tendon system.

The aim of this work was to investigate the relation between an AIED of the quadriceps femoris, the thickness of the patellar tendon (T-PT) and the knee joint status in PWH.

Subjects & Methods:

Of 14 PWH (age: 47 ± 8 years, height: 178 ± 6 cm, weight: 81 ± 14 kg; 10 severe haemophilia A, 2 severe haemophilia B; 1 moderate haemophilia A; 1 mild haemophilia A) with a verified AIED of quadriceps strength T-PT was measured in both legs by ultrasonography. Quadriceps strength was evaluated by a maximum voluntary isometric contraction test (MVIC) with a knee extensor device (SCHNELL, Germany) at a defined device angle of 75° knee flexion (Figure 1). The weaker and stronger extremity of each individual were pooled into the groups $MVIC_{minor}$ or $MVIC_{major}$, respectively.



Fig. 1. Measurement of quadriceps strength

Ultrasonography was performed by an orthopaedist with a SonoScape S8 high-resolution-system SonoScape Co., Ltd., Shenzhen, China). We used a 5-15 MHz linear-array transducer (Model L743) and examined the infrapatellar region with longitudinal scans on the extended knee in supine position. The lower patella pole and the tuberositas tibiae have been the reference points for measurement of length of the patella tendon. The thickness was measured in the middle of these line (Figure 2). For an orthopaedic joint classification of the knees the clinical score of the World Federation of Hemophilia Physical Joint Examination instrument (WFH score) was used. The highest possible knee score value is 12. A higher score implies more distinct structural and functional joint deficits.

References

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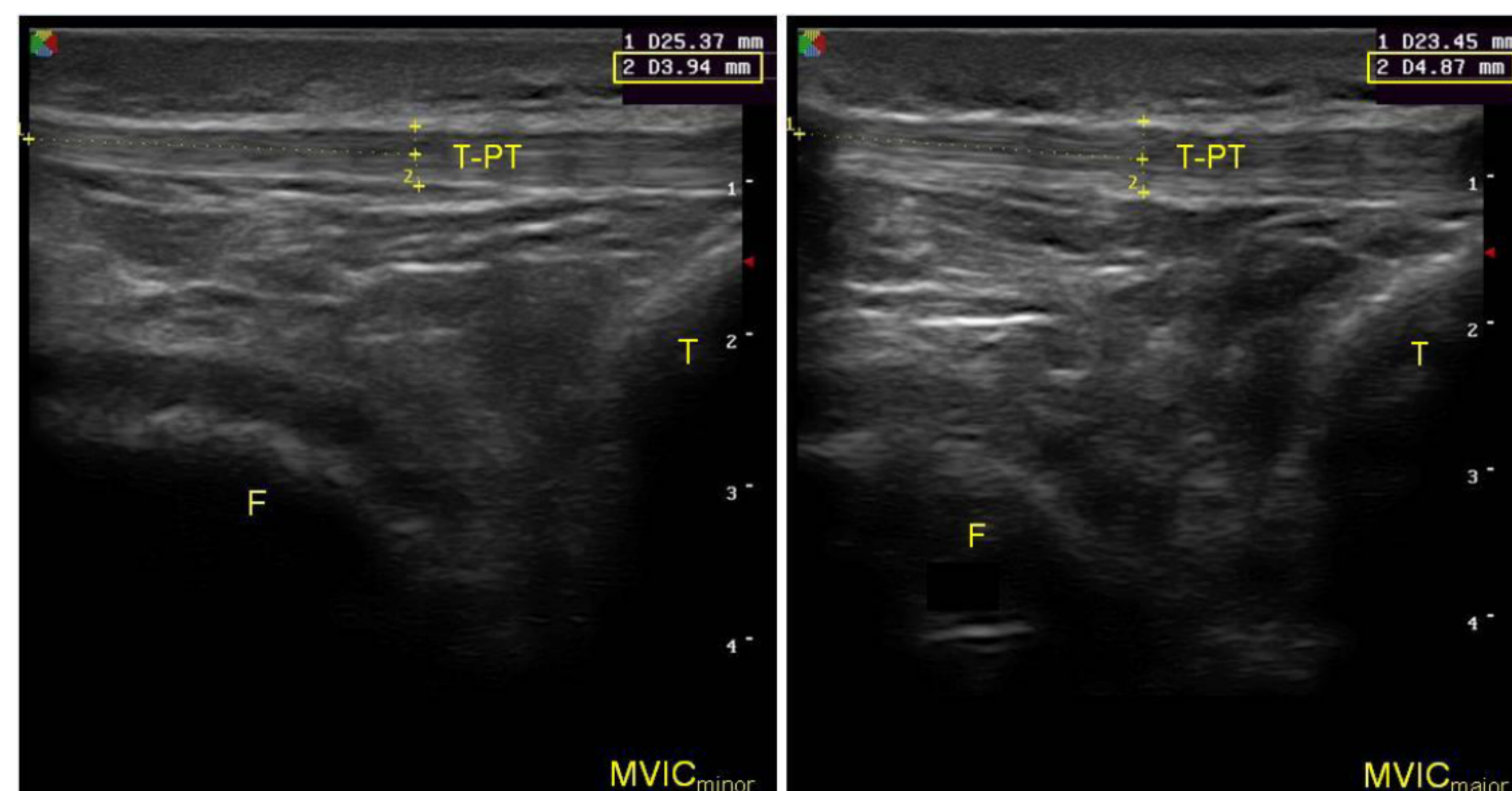


Fig. 2. Thickness of patellar tendon (T-PT) of the extremity with minor ($MVIC_{minor}$) and major quadriceps strength ($MVIC_{major}$) in a 39 year old patient with severe haemophilia A with a verified AIED. F = Femur, T = Tibia

Results:

The average inter-extremity difference of the quadriceps strength was $44 \pm 15\%$. The T-PT was significantly thinner (-15%) in all pooled weaker extremities compared with the stronger ones. In addition, the WFH score of the knee joint was remarkably higher at the weaker extremities (Table 1).

Tab. 1. Quadriceps strength (MVIC), thickness of patellar tendon (T-PT) and orthopaedic status of knee joint (WFH score) of pooled extremities with minor ($MVIC_{minor}$) and major quadriceps strength ($MVIC_{major}$) of persons with haemophilia (N = 14).

Variable	$MVIC_{minor}$	$MVIC_{major}$
MVIC [Nm/kg]	1.32 ± 0.59 (0.64-2.28)***	2.42 ± 0.94 (1.00-4.01)
T-PT [mm]	3.67 ± 0.49 (2.85-4.86)**	4.30 ± 0.92 (3.0-5.86)
WFH score	5.86 ± 3.39 (1.0-10.0)**	2.36 ± 3.00 (0.0-9.0)

The data are presented as mean values \pm standard deviation (min-max). **/** indicates a significant difference at $p < 0.01$ or $p < 0.001$ between $MVIC_{minor}$ and $MVIC_{major}$ (paired student's t-test)

Conclusions:

Our data show that an AIED of quadriceps strength is linked with a diminished patellar tendon thickness and a worse structural and functional status of the knee on the weaker side. It can be assumed that the considerable thinner patellar tendon on the weaker side goes along with a reduced mechanical loading capacity and therefore leads to an increased injury risk during daily activities.

Therefore early implementation of preventive and rehabilitative muscle training programmes are necessary in order to avoid the development of an AIED.

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