Risk communication in prevention of venous thromboembolism in sportsmen

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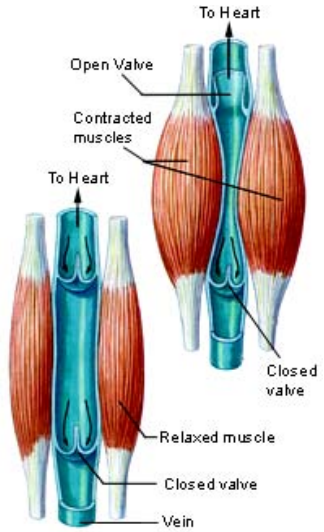
Sport as recommended activity in phlebology

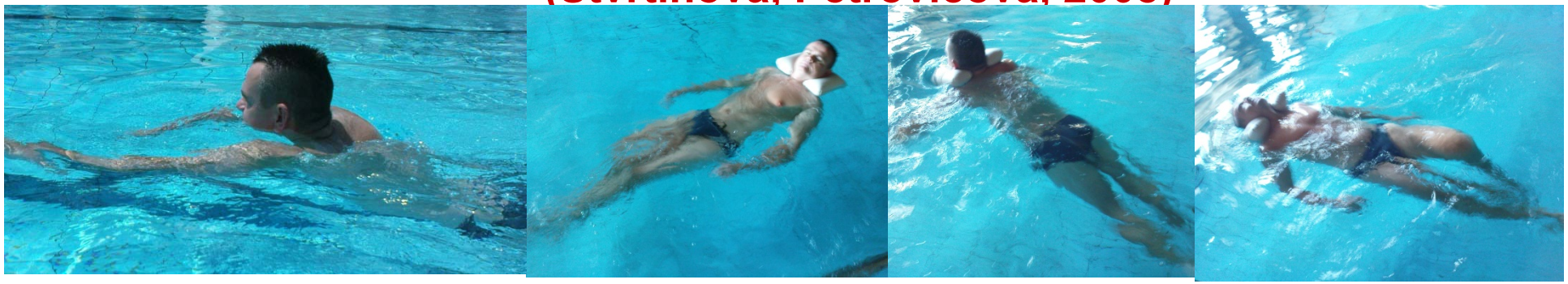
Recommended sports combine rhytmical motions in thalocrural ankle with working calf muscles



Swimming leads to required decrease of venous press by three mechanisms:

1. Rhytmical motions of muscle pump
2. Horizontal position
3. Press by surrounding water

(Štvrtinová, Petrovičová, 2008)



Sport and coagulation

MEGA study –

population-based case-control study

? whether participating in sports activities on a regular basis was associated with VTE risk

- 3 608 consecutive patients with first VT venous of the leg or PE – 31,5% of them participated in sports activities
- 4 252 randomly selected control subjects from general population - 39,7 % participated in sports activities

- Participating in sports activities reduced the risk of VTE compared with no participating OR 0,64;95% CI 0,58-0,71
- Risk reductions were similar after adjustment for sex, age and BMI OR(adj) 0,71;95% CI 0,64-0,78 and when the analysis was restricted to healthy individuals OR(adj) 0,7;95% CI 0,58-0,78
- No differences in risk were found for various frequencies, intensities and types of sport

van Stralen KJ, Le Cessie S, Rosendaal FR, Doggen CJ, J Thromb Haemost. 2007 Nov;5(11):2186-92

Intensive regular exercise has a systemic anti-inflammatory effect

- **An intense physical exercise** induces an inflammatory reaction of muscles and tendons as demonstrated by the delayed increase in blood of acute phase proteins and among them of CRP
- There is also evidence for a diminished acute phase reaction due to **regular exercise** suggesting a suppression of the inflammatory response through training.
- CRP was measured by a sensitive enzyme immunoassay before and after **9 months** of training in **14 subjects preparing for a marathon**
- The mean distance run per week increased significantly from 31 +/- 9 km at the beginning to 53 +/- 15 km after 8 months of training ($p < 0.01$). The aerobic capacity rose significantly.
- In 10 of 12 runners base-line **CRP was diminished after training in spite of a continuous increase of training intensity**. The CRP median fell from 1.19 mg/L before to 0.82 mg/L after training ($p < 0.05$).
- In 10 non-training control subjects the CRP median did not change significantly during the same 9 months period.
- **Concentration of CRP in plasma a predictive value for the risk of cardiac infarction, venous thrombosis or stroke.**

Mattusch F - Int J Sports Med - 01-JAN-2000; 21(1): 21-4

But: Sport activities may lead in certain cases to enforcing Virchow trias (I)

Hypercoaguability:

- Excessive perspiration without adequate liquid supply
- Restriction of liquids or abuse of diuretics in order to „drawing“ muscles
- Polyglobulia, Erythropoietin
- Using of contraceptives
- Anabolic steroids
- Former unknown inherited thrombophilia or malignancy

Altitude

- **9 international swimmers lived and trained for 13 days similarly at 1200 m (T1200) and 1850 m (T1850). The two altitude training periods were separated by six weeks of sea level training.**
- **The 2000 m performance had improved during T1200 (1476 (34) to 1448 (45) seconds) but not during T1850 (1458 (35)v 1450 (33) seconds).**
- **Mean cell volume increased during T1850 (86.6 (2.8) to 88.7 (2.9) [micro]m3) but did not change during T1200 (85.6 (2.9)v 85.7 (2.9) [micro]m3).**
- **The proportion of reticulocytes decreased during T1200 (15.2 (3.8)% to 10.3 (3.4)%) and increased during T1850 (9.3 (1.6)% to 11.9 (3.5)%).**
- The short term effects of 13 days of training at 1200 m on swimming performance appear to be greater than the same type of training for the same length of time at 1850 m. **As mean cell volume and proportion of reticulocytes only increased during training at 1850 m, the benefits of training at this altitude may be delayed and appear later on.**

Roels, B; Hellard, P; Schmitt, L; Robach, P; Richalet, JP; Millet, GP
British Journal of Sports Medicine. 40(2):e4, February 2006

Erythropoietin

The use of EPO was banned by the International Olympic Committee in 1990.

Typically, blood doping involves removing **2 to 4 units (900-1800ml) of blood** from an individual. After a 2-3 month time delay, which allows for restoration of RBC in the athlete, and about 3-5 days before competition, the RBC are "washed" and reinfused.

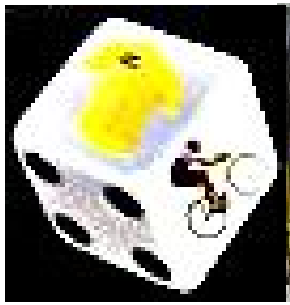
For sport use, the dosage of **EPO** is usually 20-40IU/kg 3 times/week i.v. or s.c.

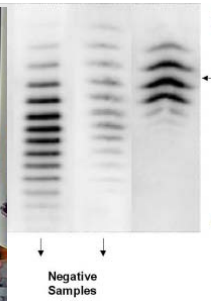
The most common side effect of **EPO** appears to be an increase in blood pressure. Ensuing constriction could possibly have very serious side effects, including death. It has been suggested that between 1987 and 1990, 19 Dutch and Belgian cyclists died from suspected misuse of EPO.

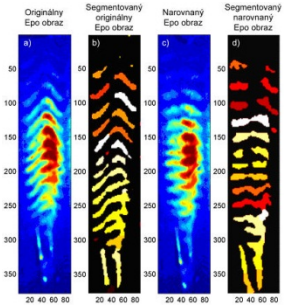
Epoetin beta allows continuous stimulation of erythropoiesis and dosing once per month.

Repoxygen could officially be classified as gene doping. It uses viral transmission of a vector bearing the human EPO-gene, and can make muscle cells start to produce EPO.

National Strength and Conditioning Association, 2008







Influence of contraceptives on coagulation

Estrogens

- ↑ f.VII, IX, X, XII a XII
- ↓ AT III and protein S
- ↑ aggregability of thrombocytes

Progestagens

- 1-st generation – in combination with 30 μg ethinylestradiol significantly decreases AT III
- 2-nd generation – in combination with 30 μg ethinylestradiol no significant changes
- 3-rd generation – twise increase risk of VTE in comparision with 1-st and 2-nd progestagens

Cyproteronacetat - pregnan, 4 times increases risk of VTE in comparision with propestagens II-nd generation

Anabolic steroids

athletes have been taking anabolic steroids since the early 1960's

short-term effects of oxandrolone, an anabolic androgenic synthetic steroid, on blood coagulation and the hemostatic/fibrinolytic system in healthy individuals. Subjects (n = 14) were administered oxandrolone (10 mg twice daily) for 14 days.

After 7 days the plasma **plasminogen** level significantly increased [100% +/- 21% to 174% +/- 21% (P < 0.0001)].**PAI-1** was significantly decreased at day 3 [16 +/- 9 to 7 +/- 4 mg/dL (P < 0.01)].

Coagulation **factors II and V** significantly increased at day 14 [88 +/- 15 to 122 +/- 11 (P < 0.005) and 105 +/- 21 to 179 +/- 36% (P < 0.0001)], respectively. **Factor VII** level decreased by day 3 [91% +/- 26% to 83% +/- 18%, NS], but after 14 days factor VII level returned to baseline (91% +/- 26% to 93% +/- 19%, NS).The increase of **factor VIII** level was not significant (111% +/- 64% to 125% +/- 55%, NS). **Factor X** increased steadily over 14 days of drug treatment

[96% +/- 11% to 107% +/- 25%, NS] Fibrinogen decreased by 22% +/-12%(NS).

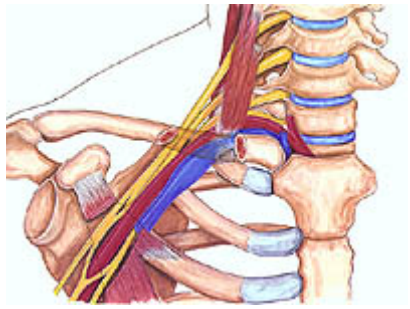
Administration of oxandrolone to healthy young men was associated with a significant increase in select blood coagulation factors and plasminogen. These changes create a state of potential hypercoagulability that appears to be counterbalanced by increased fibrinolytic activity to maintain homeostasis.

(Kahn NN, Sinha AK, Spungen AM, Bauman WA, Am J Hematol.2006 Feb;81(2):95-100)

But: Sport activities may lead in certain cases to enforcing Virchow trias (II)

Stasis of blood:

- Travelling
- Tight footwear or clothes
- Excessive abdominal press in bodybuilding
- TOS – press by hypertrophic muscles
  push-up exercise
- One-sided motion: cayaking



But: Sport activities may lead in certain cases to enforcing Virchow trias (III)

Damage of venous wall:

- Trauma: collision and contact sports
- Healing of traumas - surgery, immobilisation, plaster cast, external fixation

what to drink?, what not to drink?
what to eat? what not to eat?
what to wear? what shoes to wear?

to continue in sport activity at all? in full extent? how to increase loading? where are limits? additional sport activities? how to travel? how to avoid trauma? what to do in case of trauma?when is surgery needed? how to have a rest? which rehabilitation modalities?

Modus vivendi

Respect value priorities and goals of sportsman

Prevention of thrombosis

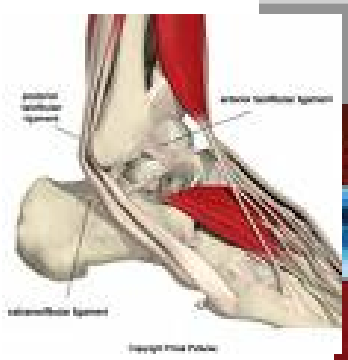
After thrombosis:

How to treat – anticoagulation therapy, compression therapy

How to continue in sport activities - limitations

Education

- Sportsman
- Coach
- Manager
- Sports medicine



Modus vivendi

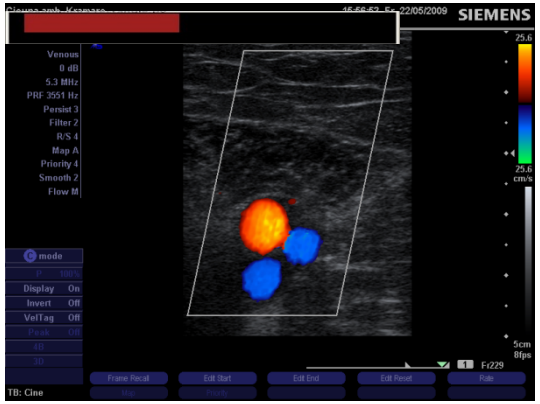
- **Prevention of recurrence** – nonmedical measures for the whole life
- Exposure
- Compliance - reeducation
- Anticoagulation therapy:
  self monitoring of INR
  patients among sportsmen wait
  for new anticoagulation therapy – anti Xa,
  direct thrombin inhibitors
- **education of other team members**
- **Psychological press**
  expectations, efficiency, responsibility
  doping, money, drugs

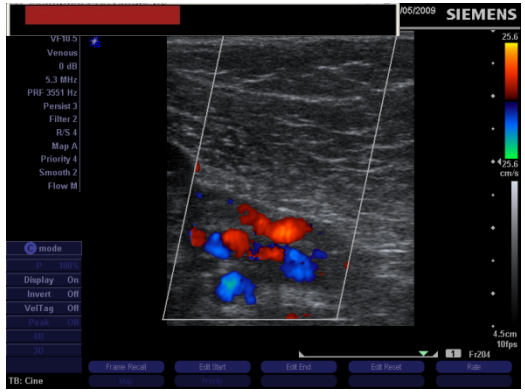
Case report (I) 53y.

doing sports the whole life: football..

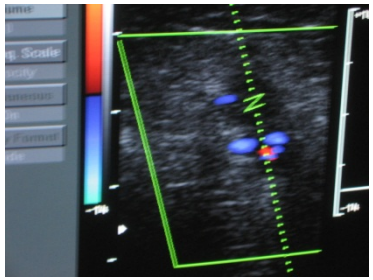
ice-hockey.. basketball.. orienting runnig .. skiing.. Cycling..manages tours in mountains for group of cyclists member of Slovak Cycling Federation

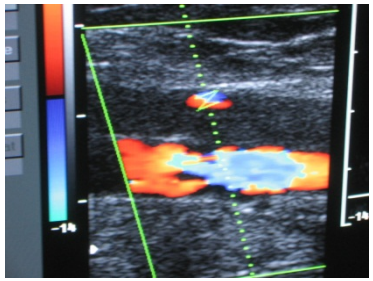
- **Femoro-popliteal thrombosis l. sin. + embolisation recid.** (2000, 2001, 2004), completly recanalised
- **secondary PTS** – left calf without compression stockings + 6cm
- F V Leiden G1691A heterozygot, MTHFR A1298C heterozygot
- Hb 159 g/l...166g/l, EPO 24,8 mU/ml

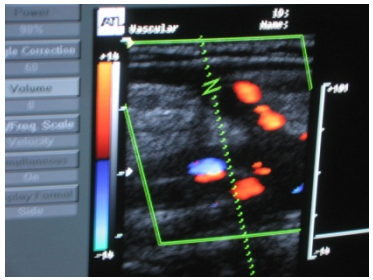




Case report (II) 21y.

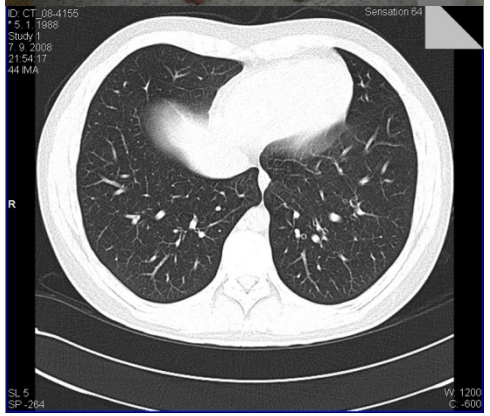






He played ice-hockey in the beginning of august. He fixed firmly his shin guard by tape before match…he travelled from Bratislava to and from Balaton by a car (4+4 hours)…

CDS: phlebothrombosis VP l.dx. and distal part of VFS l.dx., thrombophlebitis VSP l.dx.



Genetic tests of patient:

F V Leiden G169A - homozyg
MTHFR A1298C - heterozyg

Genetic tests of his ancestors:

•Mother, phlebothrombosis after delivery
•Mother's sister-twin, no manifestation of TE
F V Leiden G169A - heterozyg
MTHFR A1298C - heterozyg

The anticoagulation therapy now limits favourite sport activity of the patient, what is for him not only hobby but also an integral part of his business (he sales ice-hockey equipment).

Case report (III) 25y.

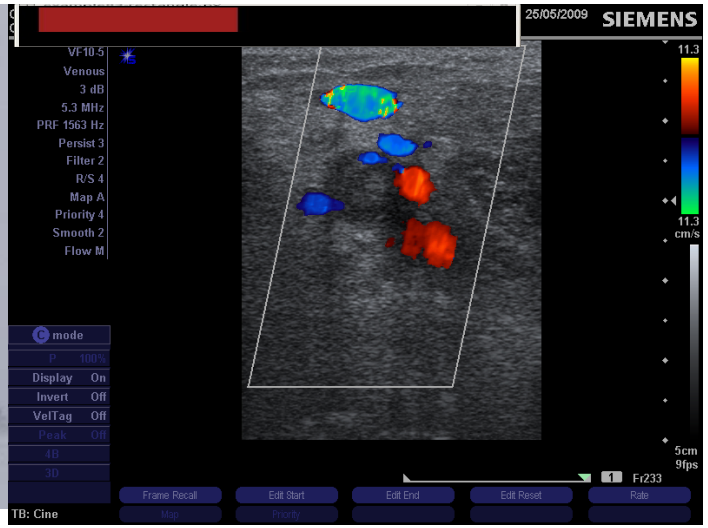
- 25.3. - knee **trauma** in downhill ski in Alps (race), **surgery**…

  3 weeks LMWH, 10.5. – dyspnoe…CT angiography - **emboli** in both of branches a.pulmonalis
- CDS - **thrombosis of v.poplitea l.sin.**
- MTHFR A1298C – heterozyg
- MTHFR C677T - heterozyg

Student of Faculty of Physical Education and Sports

Alpine Ski World Cup

Coach of junior skier



at the elite level or enthusiast

The pathogenesis of venous thromboembolism is multifactorial. All risk factors, either congenital or acquired, are relatively "innocent" when considered alone. However, when an individual is unlucky enough to inherit one or more abnormality, compounded in many cases by environmental hazards, that person may be propelled over a threshold that precipitates the development of thrombosis.

Lippi G, Franchini M, Semin Thromb Hemost. 2008 Nov;34(8):747-61.