

# BLOOD DOPING PATTERNS

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GIUSEPPE d'ONOFRIO

# Questions for the Expert panel

- A. analytical and peri-analytical aspects (complete: instrument reports, storage temperature, QC, etc.) → *can the abnormal result be explained by the analytical or pre-analytical process?*
- B. physiological variability → *can it be explained by the influence of environmental conditions or exercise before or at the time of sample collection?*
- C. pathological events or conditions → *can it be explained by a congenital disorder or an acute event (blood loss, surgery, etc.)?*
- D. **blood doping** → *can the abnormal result be explained by one or more of the known blood manipulations?*

# How likely is the abnormal Athlete's profile assuming :

- ⊙ ESA intake?
- ⊙ recent suspension of ESA?
- ⊙ blood withdrawal?
- ⊙ blood reinfusion?
- ⊙ EPO microdoses?
- ⊙ EPO combined with transfusion?
  - blood boosting for collection
  - EPO stimulation after reinfusion
  - ....
- ⊙ any of these masked by dilution?

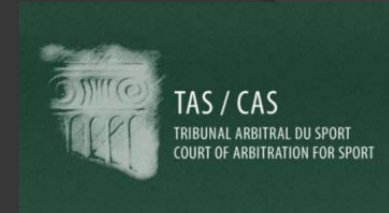
Avoid speculations and description of a rigid, detailed scenario in the first individual opinion and in the joint panel report.

# Blood doping scenario

- ⦿ Definition: a postulated sequence or development of events
- ⦿ In ABP: hematologic constellation indicating a specific manipulation, on the basis of published experimental studies → i.e, the OFF phase
- ⦿ Patterns within a sequence
- ⦿ Information from athlete's biographies and depositions, CAS awards, physiopathology of erythropoiesis
- ⦿ New doping scenarios:
  - low-doses, intermingled ESA-transfusion
  - ESA doping for training, far from races

The word  
«compatible»  
is not  
appropriate  
(better: likely,  
plausible...)

# Doping scenario at CAS



## ◎ CAS n. 1:

- “A match with the Athlete’s competition schedule is additional evidence to be taken into account if the abnormality occurs at a time when the Athlete in question could benefit from blood manipulation.”
- “A chronological coincidence reinforces the inferences to be drawn if attributing the abnormal values to blood manipulation.”

## ◎ CAS n. 2:

- “Explanations must be decided on the basis of the scientific evidence alone, and cannot be influenced by circumstantial evidence as to the motive or opportunity for the rider to have used a prohibited substance or method.”

# Pattern n. 1: the ON phase

- ⦿ Within a sequence, one or more samples display **high HB, high retics, normal OFFs**
- ⦿ Scenario:
  - Ongoing ESA stimulation
    - pre-competition (naif athlete, Helsinki 2012)
    - out-of-season
      - preparatory to blood collection (winter in cycling)
      - increased training and recovery (Africans, not only)
  - Altitude (uncertain: when HB is high, reticulocytes should be normalized)
  - If stable, congenital erythrocytosis should be considered

## Pattern 2: reactive ON, decreased HB

- ◎ Low or low-normal HB, high reticulocytes, low OFFs (erythropoietic stimulation)
- ◎ Scenario:
  - blood withdrawal (for frozen or refrigerated storage) → October, after 2013 Moscow WCh, winter sports in summer, cyclists after preparatory small tours
  - early onset of ESA intake
  - medical condition: blood loss, donation, hemolytic anemia, pregnancy

# Pattern n. 3: OFF, *the top player*

◎ High HB, low retics, high OFFs

◎ Scenario:

- typical OFF phase consequent to:
  - cessation of ESA courses before competition
  - reinfusion of an important amount of blood
- in moderate form, 2-3 weeks after return from a long stay at high altitude



# Pattern n. 4: «decapitated» OFF

- ⊙ Normal-to-low HB, low retics, moderately high or normal OFFs
- ⊙ Scenario:
  - hemodilution (oral or intravenous), masking a typical OFF phase
  - return from a stay at high altitude
  - exceptionally, medical conditions should be considered (viruses?)

# Pattern n. 5: «amputated OFF»

- ◎ Various increased HB, normal or slightly increased reticulocytes, normal OFFs
- ◎ Scenario:
  - ESA microdoses (after regular dose course)
  - African pattern: ESA intake + altitude hypoxia (lower HB INC, at sea-level competition sites)
  - first days after reinfusion of blood
  - first weeks of a stay at high altitude
  - exceptionally, medical conditions should be considered

# Pattern n. 6: normalization of an abnormal passport

- ◎ Scenario  
(deterrence effect):
  - change of doping strategy
  - cessation of doping
- ◎ Alternative explanations:
  - change of training programs
  - different hypoxic exposure
  - change of discipline

# Pattern n. 7: abnormalities in a previously normal passport

- ⦿ Strong long-lasting baseline
- ⦿ Sudden occurrence of typical doping anomalies
- ⦿ Scenario depends on the type of anomalies
- ⦿ Athletes can change doping tactic or decide for doping during their career
  - to maintain top level (increasing age)
  - to imitate known doping competitors

# Pattern n. 8: paradoxical changes

- Increased HB during long, multistage races (instead of the expected hemodilution)
- Scenario: reinfusion of blood
- Alternative scenario: physiological adaptation (?)

Mørkeberg JS, Belhage B, Damsgaard R. Changes in blood values in elite cyclist. *Int J Sports Med.* 2009 Feb;30(2):130-8.  
Gore CJ, Mørkeberg J, Schmidt W, Garvican LA, Fellman N. Plasma volume shifts during multiday racing. *Clin Chem Lab med* 2012

