

Letter to the Editors

Little soldiers in their cardboard cells

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As medical professionals with long-standing experience in sports physiology and sports medicine in both the academic and sports world, we would like to comment on the recent manuscript by Heuberger *et al.* [1] regarding the lack of evidence for the efficacy and the negative risk-benefit of erythropoietin (EPO) use in cycling. Indeed, it has been a moving sports summer, with the confession by dozens of professional cyclists of the use of, among other substances, erythropoietin, with the public confession of seven times Tour de France winner Lance Armstrong as the anticlimax. Erythropoietin use was like taking cups of coffee in the cycling world according to the following quotation: 'Hey Dude, you got any Poe I can borrow? Lance pointed casually to the fridge. I opened it and there, on the door, next to a carton of milk, was a carton of EPO, each stoppered vial standing upright, little soldiers in their cardboard cells.' [2].

Heuberger and co-workers concluded in their review that the above-mentioned 'systematic' use to enhance sports performance by EPO is scientifically unsupported by evidence and is a medical malpractice. As far as the latter is concerned, we fully agree that the use of EPO may lead to unintended and unwanted side-effects and, in most cases in which athletes are involved, can be classified as malpractice. However, according to international medical standards it is not easy to prove medical malpractice. For medical doctors to be charged of malpractice it must be shown that: (i) there is lack of adherence to recognized medical standards by which a health care professional should work (if the standard care is violated, there may have been negligence); (ii) the patient's injury must have very damaging consequences; and above all (iii) it has to be proved that the negligence caused harm or injury. An injury with no negligence is not malpractice, nor is apparent negligence if there is no injury.

Given that the patients (read 'athletes') are 'part of the deal' themselves, points (ii) and (iii) are very hard to be proved and seldom lead to malpractice. In their manuscript, Heuberger *et al.* [1] provided evidence only for non-adherence to recognized medical standards based on possible general side-effects of EPO, but it would have

strengthened their well-intended message if they had included a practical case. These are, however, rare for EPO use. However, the inexplicable fall uphill during the Tour de France 2003 of Jesus Manzano, the whistleblower of systematic doping within cycling, which led the Spanish Guardia Civil to conduct the Operación Puerto, was probably caused by almost lethal anaphylactic shock. This is an example of proven malpractice that matches all the aspects mentioned above.

Heuberger *et al.* [1] also state that the claimed performance-enhancing effects of EPO in cycling are unsupported by scientific evidence. The evidence provided within their manuscript is, in our opinion, based on erroneous interpretations of the published literature cited.

In the past, we have shown that power output, the main parameter that determines cycling performance, has a high ($r = 0.98$) correlation with maximal oxygen uptake ($\dot{V}_{O_{2max}}$) [3]. Thus, $\dot{V}_{O_{2max}}$, alone or in combination with other parameters, is an important variable that predicts cycling performance.

Evidence for our claim comes from the studies of Bouchard *et al.* [4], who have shown in the HERITAGE study that, based on genetic traits and/or environmental input, the average gain in $\dot{V}_{O_{2max}}$ is 30% (range between -5% and +56%). The 6.3% (lowest increase in Table 1 of Heuberger *et al.* [1]) and 9.3% gain (highest gain in Table 1 of Heuberger *et al.* [1]) in $\dot{V}_{O_{2max}}$ by the use of EPO make up between 10 and 20% of the maximal gain as shown by Bouchard *et al.* [4].

How do the above-mentioned values for $\dot{V}_{O_{2max}}$ gain relate to daily cycling practice? Are there sports scientific reasons for cyclists to use EPO?

The one and only performance parameter that has value for an athlete are the results during a sports event itself. To rule out tactics and teamwork, we have analysed all Tour de France individual time trials longer than 15 km since 2000. The time difference between winners and runners up was 1.2% ($1.2 \pm 0.77\%$) and between the winner and the cyclist ranked number 50 was on average 9.2% ($9.2 \pm 2.15\%$).

Given that time trials reflect power output and thus $\dot{V}_{O_{2max}}$, the small differences between cyclists in an

individual time trial and the range in $\dot{V}_{O_{2,max}}$ gain (6.3–9.3%) after the use EPO provide both scientific and practical evidence that the use of EPO may lead to performance enhancement.

We fully agree with Heuberger *et al.* [1] that we should be harsh on medical colleagues regarding the medical use of EPO in obviously healthy athletes. However, in order to ban the unjustified use of medication from sports, first of all we need to be fair in our communication to athletes and admit that EPO is a performance-enhancing drug.

Competing Interests

All authors have completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

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