An Overview on Erythropoietin Use in Sport

Rajesh Kumar Siwach

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1. Introduction

Erythropoietin (EPO) hormone increases the red blood cells (RBC) in the blood. EPO are used by sportsman to execute better performance in endurance events. Because of EPO the viscosity of blood increases which add to the risk of blood clotting and may lead to a stroke. The most recent means of artificially boosting RBC counts involves a drug that has been the target of accusation and speculation among the professional cycling world for more than a decade. Erythropoietin (EPO) is a naturally-occurring hormone, produced by the kidneys, that stimulates the production of red blood cells. This hormone can also be manufactured and injected into the skin or directly into the blood stream. EPO may be used in medical practice to bring patient's RBC into normal levels. The use of artificial EPO as a means of increasing athletic performance first showed up 1980s and has recently been linked with drug-use scandals in professional cycling. Despite the creation of an EPO detection test in 2000, some claim that EPO doping is still widespread in pro sports. In 2012 disgraced U.S. cyclist Lance Armstrong has been personally urged to make a full confession of all his involvement in doping by the founder of the lobby group Change Cycling Now. Erythropoietin (EPO) is part of a large process of haematopoiesis that involves the production of mature cells found in the blood and lymphoid organs. Haematopoiesis is continuously required because of normal turnover in cell populations of blood and lymphoid organs. In the normal adult human, the daily turnover of erythrocytes exceeds 1011 cells. In periods of increased erythrocyte loss due to haemolysis or hemorrhage, the production of erythrocytes increases rapidly and markedly. However, an overproduction of erythrocytes does not occur even after the most severe loss of erythrocytes. In haematopoiesis, a few rare hematopoietic stem cells in the bone marrow reproduce and differentiate to give rise to all the cellular components of the blood and the lymphoid system. During this process, an individual hematopoietic cell undergoes an apparent random process called commitment. When a cell undergoes commitment, its proliferation becomes limited and its potential to develop into multiple types of mature cells is restricted. Thus, these hematopoietic cells are referred to as committed, lineage-specific progenitor cells.

The major stages of differentiation in mammalian erythropoiesis are: The most immature stage of committed erythroid progenitors is the burst-forming unit-erythroid (BFU-E). The next major stage of erythroid progenitor cell development is the colony-forming unit-erythroid (CFU-E). A continuum of erythroid progenitor stages exists between the BFU-E and CFU-E, with decreasing proliferative potential as the progenitors approach the CFU-E stage. The descendant cells of the CFU-E are termed elytroid precursor cells. The erythroid precursors are proerythroblasts, basophilic erythroblasts, polychromatophilic erythroblasts and orthochromatic erythroblasts. The orthochromatic erythroblasts do not divide but they enclose, forming of immature red blood cells, the called the reticulocyte.

2. Methodology

This survey is an analysis of literature on of up to now research conducted on EPO in sports medicine. The analysis involves a dozen scientific databases, examined in order to find out the adverse effect on health. The gathered data are supplemented and verified from the web source of WADA, NADA, Wikipedia, Elsevier, PubMed, Google-scholar, Copernicus and National Dope Test Laboratory.

3. Mechanism of Erythropoietin Action

As far as athletes are concerned, use of synthetic EPO offers a means to increase arterial blood oxygen content, which in turn leads to an increase in maximal oxygen uptake. Endurance sports such as swimming, running, rowing and cycling stand to benefit most from an increase in maximal oxygen uptake as this is one of the limiting factors for performance. An additional benefit of EPO use is once administration is discontinued, red blood cells only return to their original levels very slowly, i.e. about a month. This effectively means an “open window” may exist where there is no evidence of EPO misuse but where performance is still
enhanced. Furthermore, the enhanced red blood cell mass may allow the athlete to sustain a greater training stimulus, which could produce a subsequent improvement in performance potentially quite remote in time from when there is evidence of EPO misuse.

4. Relation of EPO and Sports

There are two type of EPO used in sports these are natural and synthetic, both EPO are proteins made up of the same sequence of basic elements, the amino acids. However EPO carries on its surface specific polysaccharide chains, which are slightly different in the natural and the synthetic versions of the hormone.

Endurance athletes use EPO to increase their oxygen supply by as much as 07 to 10 percent. But the main side effect is that increased red blood cell density caused by EPO thickens the blood, and thickened blood which is more like honey than water does not flow through the blood vessels well. To pump the thickened blood, the heart must work harder, and this increases the chances of heart attack and stroke.

Risk of Hepatitis: Treatment with erythropoietin worsens thrombocytopenia induced by pegylated-interferon-alpha therapy in patients with chronic hepatitis C infection.

Erythropoietin adverse effects and caution: Despite some potential adverse effects, such as hypertension, and the occurrence of erythropoietin resistance, early studies in mild heart failure patients with anemia suggest that erythropoietin therapy is effective in reducing left ventricular hypertrophy, enhancing exercise performance and increasing ejection fraction.

6. Conclusion

EPO is known for its qualities for maintaining and improving endurance. The athlete are allowed to take insulin where significant diabetes problems. Insulin was banned by the International Olympic Committee in 1998. The most common side effect use of EPO is risk of cardiac seizure, which is potentially serious and can be life-threatening; other side effects of erythropoietin use include muscle cramps, upper respiratory infections, headache, hyperviscosity, thrombosis, and hypertension, long-term use of erythropoietin use can also lead to the development of pure red cell aplasia (PRCA), which occurs from the generation of antibodies against Erythropoietin use that are able to neutralize native. We can conclude that Erythropoietin increase the level of haemoglobin has been proven to boost VO2-max. This improvement may result in a prolonged time to fatigue at ninety five percentVO2max, as well as in a lower contribution of anaerobic metabolism to energy production. The immediate and long-term adverse effects should be strongly emphasized, considering that they may occur in young and otherwise healthy subjects. Documented Erythropoietin, leading to the absence of red cell precursors in the bone marrow. The development of PRCA with chronic kidney disease receiving erythropoietin use seems to be associated with use of erythropoietin. There are many side-effects of using erythropoietin which have proven to be fatal in previous cases: Increased viscosity of the blood increases the risk of heart attack and stroke, fever, seizures, nausea, headache, anxiety, legarthry.

7. Implication of the Study

The present study will enlighten the coach and sports to search the talent in these sports coaches may ignore these factors while searching the talents.

References


**Author Profile**

Mr Rajesh received the Master Degree in Physical from MDU-Rohtak and M.Phil degrees in Physical Education from KUK, NIS Diploma in Sports Coaching (Archery) and Qualified UGC-NET in Dec 2012. He is now working on the Post of Phy Edu Teacher in Jawahar Navodaya Vidyalaya-Butana, Distt-Sonepat (Haryana) under the Ministry of Human Resource Development, Govt of India.