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Promising Feature and Challenge of Utilizing Erythropoietin Hormone to Support Emergency Teams' Activities at High-Altitude Geographical Area

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Abstract

After being deployed for any disaster or emergency, both civil and military emergency teams are expected to quickly adapt to a relatively extreme condition of geographical region, such as the possibility of hypoxia in a high-altitude area. In areas with limited amounts of oxygen, an approach to consume a certain dosage of Erythropoietin hormone could be considered to accelerate the red blood cell maturation of the emergency teams' personnel. Based on its common clinical properties in treating anemia conditions of chronic renal failure patients, this short communication proposed advantages and limitations of the utilization of the Erythropoietin hormone for supporting emergency teams' performance in terms of hypoxia condition. Because this hormone has been approved by health authorities and widely used for therapeutic purposes, this approach could be wisely considered and further developed with quite a similar purpose in terms of humanity, i.e., to help many victims of the affected area.

Keywords: *Erythropoietin, EPO, Hypoxia, Polypeptides hormone, Red blood maturation*

Introduction

Emergency teams, also particularly called emergency medical teams, are widely recognized for their valuable responses and support for helping victims and saving lives in any emergency occurrences. The teams could be established from some personnel with multidisciplinary fields of trained and qualified personnel with medical backgrounds and non-medical backgrounds, such as doctors and technicians for electricity, respectively. The personnel of the emergency team are expected to be adaptable to various conditions of affected disaster areas or conflict zones. For instance, they should have a relatively high tolerance toward particular challenges related to hypoxia, a frequent symptom due to oxygen limitation, that would be faced in high-altitude areas. For instance, the possibility of a hypoxia case should be warned by aircrews operating unpressurized cabin aircraft [1]. As an essential safety precaution to anticipate the negative effects of hypoxia, hypoxia recognition training is encouraged to enhance the related responses [2]. In addition to encouraging teams to perform enough regular physical exercises, it is required to deliver a strategic approach that can quickly boost emergency teams' performance toward significant change in environmental oxygen levels. This approach to curatively tackle hypoxia ought to be prepared.

Besides being used in medication and related post-treatment activities, the utilization of therapeutic products as a booster for physical performance is an innovative approach that would be also fairly adopted in the particular area of disaster management. Several therapeutics that demonstrated excellent clinical properties to tackle some diseases may also have potential benefits in other circumstances. For example, the biological therapeutic of Granulocyte Colony Stimulating Factor (G-CSF), an accelerator for a particular type of leucocyte level, that is widely used for chemotherapy post-treatment may have the potential to be used as an agent for accelerating wound healing. Another example related to a stimulator for increasing cell blood levels is Erythropoietin (EPO).

Discussion and Conclusion

EPO which is mainly built from compacted polypeptides with four helical domains [3] has been well-known as a hormone for enhancing red blood cell levels within the human body to avoid anemia condition. This polypeptide-based hormone is biosynthesized in renal fibroblast, hepatocytes, and neuronal cells [4]. The EPO regulates erythropoiesis through the stimulation of formation and maturation of erythroid progenitor so that the mass of red blood cells is increased and the oxygen level within some human tissues is enhanced, subsequently [5]. This hormone has been completely approved to be used for the post-treatment of chronic renal failure patients. For example, recombinant human EPO (rhEPO) is a popular safe biopharmaceutical with a high benefit in anemia conditions in the posttreatment of hemodialysis. rhEPO can restore normal hematocrit, eliminate the necessity for transfusions, and recover the quality of life of its recipients [6]. Not only positive clinical results of hemodialysis patients but also administration of rhEPO to a patient with COVID-19 also demonstrated symptom relief and viral regression [7]. In addition, it has a prospect as a neuroprotective agent [4]. The biosimilar EPO has also been routinely produced and widely commercialized by many biopharmaceutical manufacturers, commonly in the form of pre-filled syringe products. Most EPO products contain active drug substances, buffer salts, and other excipients [8].

In Indonesia, two of five active pharmaceutical ingredients (API) manufacturers are manufacturing this kind of product [9] and perhaps other companies are willing to be able to produce this valuable hormone product as well in the next several years. Because it has been regulatorily approved and massively manufactured, it is quite interesting to adopt EPO's feature to solve a problem related to the possibility of hypoxia conditions of emergency team members deployed in high-altitude geographical areas. Technically, it is simply proposed that EPO as a popular biotech therapeutic agent could be also safely injected into the emergency personnel that have just already arrived in the affected area. As a consequence, the personnel's body could enhance their red blood cell level to optimally absorb the oxygen from a lower atmospheric pressure of a high-altitude area.

As a result, the personnel could diminish the possibility of hypoxia symptoms and steadily help the victims of the affected area, immediately.

Meanwhile, for safety aspects, the personnel of the emergency team could obtain the proper dosage of EPO injection as medical teams' advice because the emergency personnel are usually accompanied by the medical personnel. Of course, it would be slightly more convincing if there is a particular efficacy testing in the condition of the high probability of hypoxia cases, such as clinical testing toward the objects placed into high-altitude areas or defined places with relatively low oxygen levels. Otherwise, they would scientifically refer to the current existing clinical testing results and carefully justify the information to propose a safe dosage of EPO injection to the health authorities. Interestingly, this innovative approach as well as the issue would be quickly responded to by the national health authorities since most of the emergency team activities should be coordinated under the Ministry of Health.

In addition to limited empirical studies regarding the efficacy of EPO injection at high-altitude areas, there would be another limitation regarding the EPO product itself. Most of the current EPO syringe products must be stored in the refrigerator with a storage temperature between 2^{o}C and 5^{o}Celsius. Otherwise, the polypeptide structure could be gradually damaged if the product is exposed to room temperature or above for a long duration. As a consequence, its functional structure and the therapeutic action could be crucially disrupted and unable to optimally function, respectively. This issue can be simply solved by many emergency teams since the pharmacists within the team usually carry cold storage for temperature-sensitive drugs and vaccines. Certainty, this condition could be applied when there is still enough space for storing drugs that are prioritized for victims. Overall, the technical limitation of EPO handling for boosting oxygen absorption in a low atmospheric pressure could be easily diminished by proper logistics management and, of course, the availability of a stabilized electric source for the refrigerator in the affected area.

In conclusion, we express that in addition to medication treatment, the regulatorily approved biotech product is also promising to be utilized for other humanitarian activities, i.e., to support the quick adaptation of emergency teams in high-altitude areas. Promisingly, EPO hormone may provide beneficial properties to prevent hypoxia caused by thin atmospheric pressure, while its limitation related to suitable products' storage condition could be simply solved by proper integration of the hormone products into the drug's storage management.

Furthermore, we suggest academics and scientists, especially those who are interested in national defense and global emergency response, develop a novel variant of EPO product that has higher temperature storage so that it can be easily transported and still optimally function toward emergency personnel in the affected area with limited or damaged electric source. Another approach that could be considered is the development of EPO packaging by using either simple or innovative materials since

through proper packaging technologies by using polypropylene syringes, the expiration date of recombinant EPO products could be extended [10].

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