Oxygen Delivery to the Tissues

Yoo Kuen Chan

INTRODUCTION

As oxygen is needed to sustain life, it seems logical to ensure that we deliver oxygen to the tissues adequately in order to serve this essential need. Looking at the pathway by which oxygen moves from the atmosphere to the tissues, allows us to focus on areas where the process may be interfered with, thus threatening life.

PATHWAY BY WHICH OXYGEN GETS TO THE TISSUE

The pathway by which oxygen gets to the tissue (Figure 3.1, overleaf) focuses on how oxygen travels from the atmosphere, through the airways into the lungs by the process of breathing, diffuses into the intact circulation, and is carried mainly by haemoglobin to the tissues. The optimal pathway is delineated by a patent airway, adequate breathing (moving of air into and out of the lungs), an adequate cardiac output, sufficient haemoglobin and normal tissue milieu.

Integrity of that pathway means that oxygen must be brought into the lungs by the process of breathing – an active process, but one that uses only very minimal energy (only 1% of total daily energy consumption) under normal circumstances. The airway must be patent – an obstructed or partially obstructed airway becomes an impediment to the delivery of oxygen from the environment to the alveolar–capillary interface. Oxygen is then picked up and taken away by the flow of blood in the circulation.

This flow is maintained by the heart, acting as a pump, which enables the delivery of blood containing oxygen to the tissues. Haemoglobin must be present in adequate amounts as it is the main carrier of oxygen in the blood. At the tissue level, oxygen diffuses from the blood, through the capillary wall, into the interstitial space and thence into the cells. Although oxygen is present at very low partial pressures at the tissue level, it is all that is needed for the production of ATP in the mitochondria and enough for survival.

Hypoxia which denotes inadequate oxygen at the tissue level can be classified into anoxic, stagnant, anaemic and histotoxic types. This classification indicates which part of the pathway of oxygen delivery from the environment into the cells has failed or malfunctioned.