Angiogenesis: An Alternate Approach To Cardiovascular Disease Treatment

Scott Ouillette
Southern Maine Community College

Follow this and additional works at: http://digitalcommons.usm.maine.edu/thinking_matters

Part of the Alternative and Complementary Medicine Commons, and the Cardiovascular Diseases Commons

Recommended Citation
http://digitalcommons.usm.maine.edu/thinking_matters/99

This Poster Session is brought to you for free and open access by the Student Scholarship at USM Digital Commons. It has been accepted for inclusion in Thinking Matters by an authorized administrator of USM Digital Commons. For more information, please contact jessica.c.hovey@maine.edu.
Angiogenesis: An Alternate Approach To Cardiovascular Disease Treatment

Scott Ouillette, Southern Maine Community College. Instructor: Lisa Dietrich, Southern Maine Community College/Maine Medical Center

Abstract

As cardiovascular disease continues to be the number one killer of humans across the globe, a new approach in treatment and prevention needs to be found. Angiogenesis is a promising young field of study that can change the way we treat patients with cardiovascular complications.

Introduction

Cardiovascular Disease: 17.3 million deaths worldwide each year

Current Treatments: Medication, CABG surgery, Minimally invasive coronary reperfusion.

Angiogenesis: Is the natural process that our bodies use to create new blood vessels from preexisting ones. Angiogenesis usually occurs in the development process of life but can occur afterward as a response to blood vessel damage. It is also used by tumors to recruit new blood vessels to feed cancer cells with oxygen and nutrients, which allow them to grow. In relation to heart disease, angiogenesis is the body’s response to blocked arteries by creating new blood vessels (called collaterals) to bypass the blockage and restore blood flow downstream to the affected artery. In order for angiogenesis to occur, biological signals known as angiogenic growth factors are sent to the receptors on the endothelial layers of the blood vessel that is requesting new blood flow. Once the basement membrane of the blood vessel has degraded enough, the new vessel escapes the old vessel and starts to grow toward the source of the original growth factor signal. [Figures 1,2]

Accelerating or enhancing the body’s natural response to blood vessel injury and tissue damage is not a new concept. In the early 2000’s scientists pioneered therapeutic angiogenesis by showing the effects of vascular endothelial growth factor in re-perfusing blood flow in a rabbit hindlimb after blood flow was cut off, this research proved that a mechanical trigger was one way to start angiogenesis. [Reference 3]

Next Steps

• Development of a stent based delivery system focusing on protein therapy/growth factor release and disabling growth factor inhibitors
• Continued research into finding the most effective growth factors
• Animal and human clinical trials using these new methods

Methods

The way angiogenesis is triggered in the body has many different steps and can be broken down into 3 categories: The mechanical trigger, the chemical trigger, and the molecular trigger. The process as a whole is more commonly known as the angiogenesis signaling cascade. Because mechanical triggers are not well known and chemical triggers is the body’s natural response to blockages during tissue hypoxia, the molecular trigger makes more sense for growth factor therapy. The centerpiece of angiogenesis research revolves around the growth factors that activate or inhibit blood vessel growth. To this date there are 19 known angiogenic growth factors and over 300 angiogenesis inhibitors. Fibroblast growth factor (FGF) is one of the most researched growth factor families, it is also one of the most effective. Another important stimulant is vascular endothelial growth factor (VEGF), which causes a large signaling cascade in endothelial cells to create new capillaries. On the other hand, angiogenic inhibitors are far more well known in large part to the research done using them as anti-cancer treatments in the 1970s. As a result of their obvious mechanism, the inhibitors are often overlooked in therapy. But inhibitors play a key role in the activation of blood vessel development. Because angiogenesis is such a tightly controlled balance of counteracting factors, checking the inhibitors and promoting the activators flicks a “switch” that allows new blood vessels to begin growing. This is better known as the balance hypothesis for the angiogenic switch. [Figure 3]

Hypothesis

Up until this point research has only focused on angiogenic activators and ineffective growth factor administration. Focusing on the angiogenic switch and the use of a biodegradable stent coated with angiogenic growth factors and anti-inhibitors for prolonged local administration would solve the problems with dosage and controlled release that could push therapeutic angiogenesis over the edge as an extremely effective treatment for cardiovascular disease.

Acknowledgements

Special thanks to my instructors: Lisa Dietrich and Norma Willis for all their help. My fellow colleagues, classmates, preceptors, friends and family for their support and encouragement. My fellow researchers for their thoughtful words of encouragement and constructive criticism of my research. I could not have done this without you.

References

References can be found on page 16 of the original paper: https://goo.gl/dBWLYk