Tissue engineering of the esophagus- role of fetal surgery

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Tissue engineering is a multidisciplinary science in which the principles of engineering are applied to biological sciences with the aim of providing solutions for current clinical problems. There is a demand for esophagus in the pediatric patients as the morbidity is high with the present surgical techniques. Tissue engineering of the esophagus is a promising alternative to transposition procedures in esophageal replacement; however, the proposition is challenging due to the anatomical complexity of this tubular organ. The principles and concepts of tissue engineering were applied relating to the sourcing of cells, design and selection of scaffolds and polymers, hybrid construct and co-culture approaches of tissue engineering and the use of bioreactors and fetal lab models to achieve the goals.

Current research in the field of esophageal tissue engineering, from in vitro studies of cell biology to in vivo large animal studies have given the required impetus towards developing an esophagus potential for large scale replacement with efforts from multiple expert institutions. Whilst many advances have already been made in tissue engineering of the esophagus, ongoing research is necessary and a number of key obstacles need to be overcome. There is a requirement for development of a new generation of hybrid scaffolds and the application of stem cells. The continued progress of in-vitro studies should be matched by an increase in the number of large animal model studies to allow for greater feedback for the polymer scientists and cell biologists. Also, current tissue engineered constructs remain as passive conduits and therefore, future work must focus on the development of a functional construct, with a neurogenic component, that may become integrated into the peristaltic activity of the esophagus.

Tissue engineering offers great potential for esophageal replacement especially with the fetal model that has offered multiple advantages. Future research will focus on the improved design of scaffold materials for guided tissue growth and organization, the development of protocols for the isolation, proliferation of esophageal and stem cells, and the optimization of devices for prolonged in vitro culture with in-vivo implementation in the fetal model.