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Bioengineered bile duct with cholangiocytes derived from human stem cells

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Introduction : In the US, between the years 1988 and 2014, 16% of all transplantations were as a result of cholangiopathies. This is due to the fact that cholangiopathies only have liver transplantation as a method of treatment. Therefore, many scientists are trying to find a way of using bioengineering methods with stem cell differentiation to provide an alternate solution as organ donors are falling short and liver transplantation need is rising.

Methods : Using small molecules and gelatin, human chemically derived hepatic progenitor cells (hCdH) were differentiated into 2D cholangiocytes in vitro. Thereafter, using a bioengineering sheet scaffold made of randomly spun nanofibers and an artificial bile duct coated with gelatin, hCdHs as well as mouse chemically derived hepatic progenitor cells (mCdH) were seeded onto them respectively for a period of two weeks and then differentiated into cholangiocytes.

Results : RT-qPCR analysis of the hCdH in vitro as well as immunohistochemistry showed that the hCdH cells differentiated into cholangiocytes in vitro. Furthermore, the hCdH were able to populate the scaffolds and show an upregulation in cholangiocytic genes seen through RT-qPCR and immunohistochemistry. Finally, the mCdH were also able to attach uniformly onto the artificial bile duct and show an upregulation in cholangiocytic genes.

Conclusions : In conclusion, through the use of gelatin and small molecules, hCdH and mCdH are able to differentiate into cholangiocytes in vitro and in bioengineered scaffolds as well as artificial bile ducts. With further experiments, this could prove to be a novel method for the treatment of cholangiopathies.

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