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Evaluating A 3D-Printed Biodegradable Paclitaxel-Eluting Stent For Biliary Stricture Management After Liver Transplantation: An In Vivo Porcine Study

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Background : Liver transplantation (LT) is the standard treatment for end-stage liver disease; however, it can lead to biliary strictures in 25–30% of cases. Current methods for treating biliary strictures involve endoscopic stent insertion, which can cause re-stricture, bleeding, and bowel perforation. We aimed to develop a biodegradable stent loaded with paclitaxel that could be inserted during surgery and left in place without requiring removal. We evaluated the safety and efficacy of this stent using a porcine model.

Methods : Fourteen pigs underwent simulated ischemic injury during LT, and a biodegradable paclitaxel-eluting stent was inserted after duct-to-duct anastomosis. Pigs were divided into four groups: no stent (n=3), bare stent (n=3), 300 μg paclitaxel stent (n=4), and 900 μg paclitaxel stent (n=4). After 3 months of follow-up, computed tomography (CT) was performed to confirm the location and degradation of the stents. Autopsies were conducted to obtain common bile duct tissue samples, and inflammation and fibrosis thicknesses were assessed under a microscope.

Results : The inflammation scores for each group were 2.67, 5.33, 3.25, and 4.0, respectively (P = 0.115). Most tissues had resolved the inflammatory reactions by the 3-month mark. The thinnest fibrosis thickness was observed in the 900 μg group (359.08 ± 167.23 μm); however, no statistical significance was observed.

Conclusions : This study demonstrated the safety of paclitaxel-eluting biodegradable biliary stents and their positive effects on fibrosis in an ischemic bile duct porcine model. This biodegradable stent represents a promising approach for overcoming the complications associated with biliary strictures after LT.

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