DEVELOPMENT OF A BILE DUCT SIMULATOR MODEL USING 3D PRINTER TECHNOLOGY

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A 3D-printed bile duct simulator model based on real imaging data was developed and evaluated for guidewire manipulation training, demonstrating that guidewire diameter significantly affects torque performance and access time.

KEY POINTS

- The simulator reproduced bile ducts B2 to B8 using epoxy resin from DIC-CT/MRCP images and allowed guidewire operations in a water-filled environment similar to actual procedures
- Three guidewire diameters (0.018, 0.025, and 0.035 inch) were tested by a clinical engineer with over 500 ERCP cases and a physician with over 5000 cases, each performing five attempts per guidewire
- Complete bile duct reach rate was 40% for 0.018 inch guidewires and 100% for both 0.025 and 0.035 inch guidewires, with all failures occurring at B7 insertion
- Median time to complete reach decreased significantly with larger diameter: 120 seconds for 0.018 inch, 56 seconds for 0.025 inch, and 40.5 seconds for 0.035 inch ($P < 0.01$)
- The authors suggest that reaching all bile duct branches within 60 seconds could serve as a guideline for product development and training goals

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