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TITLE

Endobiliary Radiofrequency Ablation with Bipolar Self-expandable Electrode for Unresectable Malignant Biliary Obstruction

BACKGROUND

Endobiliary radiofrequency ablation (RFA) increasingly being used to relieve malignant biliary obstruction and prolong stent patency. However, limited ablation ranges caused by insufficient contact between the electrode and the bile duct wall was a significant obstacle for successful endobiliary RFA. The efficacy and safety of the bipolar self-expandable electrode (SE) with a customized RF generator in the porcine common bile duct (CBD) was investigated and the ablation ranges of the electrode according to different ablation protocols was validated.

METHODS

The bipolar SE and a customized RFA generator were developed and characterized to perform the endoluminal RFA procedure. The optimal frequency for endobiliary RFA procedure was determined through impedance measurement of porcine CBD. RF parameters were validated in the extracted porcine liver. RFA with bipolar SE and customized RFA generator using the nine ablation protocols was evaluated in the porcine CBD. The efficacy and safety of RFA were examined by cholangiography, endoscopy, histological examination, and immunohistochemical analysis.

RESULT

The bipolar SE with a customized RFA generator was successfully fabricated with high accuracy and reproducibility. Ablation ranges significantly and proportionally increased with ablation time and output power in the porcine liver ($p < 0.001$) and extrahepatic bile duct ($p < 0.001$). Output power was more influenced the ablation length ($\square = 0.736$ vs. 0.644) and depth ($\square = 0.727$ vs. 0.574) compared with time. Degrees of tissue damage, luminal narrowing, and histological findings including TUNEL- and HSP 70-positive areas were significantly increased in RFA parameter-dependent manner (all $p < 0.05$).

CONCLUSIONS

Direct and local endobiliary RFA with a newly developed bipolar SE and customized RFA generator seems to be effective and safe to generate circumferential ablations in the porcine CBD. Ablation ranges can be easily controlled by simply adjusting output power and time.

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