

## The development of novel tantalum radiopaque marker

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**Background/Aims:** Self expandable metal stent (SEMS) can be used to treat biliary obstruction. Radiopaque metal markers are required to improve the X-ray absorption of SEMS in order to precise stent placement. The tantalum markers manufactured by ultrasonic spray technique was developed currently. The aim of current study was to evaluate the safety and visibility of the marker. **Methods:** A total of three adult male beagle dogs were used in absorption test in gastrointestinal (GI) tract. Five of the tantalum markers were placed into stomach of each beagle dogs endoscopically. Excreted markers were collected and measured weight of marker. The weight was compared to those of original marker to evaluate the quantitative loss of marker in the gastrointestinal tract. In radiopacity tests, the marker's radiopacity on X-ray image was measured using image J and compared the brightness score to controls. A total of commercially available metal markers (gold, A, B, C; platinum, D) from different companies were used as controls. Lastly, the radiographic images of six patients with unresectable malignant extrahepatic biliary stricture were used and compared the brightness score between SEMS with tantalum marker ( $n=3$ ) and SEMS with gold marker ( $n=3$ ) on fluoroscopic images. **Results:** In three dogs, all markers were defecated and were able to collect in 33 hours with maintained normal structure of marker. The weight of tantalum marker in fecal excretion was not different with those of intake. The mean brightness score and total brightness score is greater in novel marker than other markers. On fluoroscopic image, SEMS with tantalum marker has higher brightness score and total brightness score after placement to human bile duct than those of SEMS with gold marker. **Conclusions:** The novel tantalum marker is highly resistant for gastrointestinal absorption and the visibility of the marker is superior to those of other commercially available markers in X-ray images.

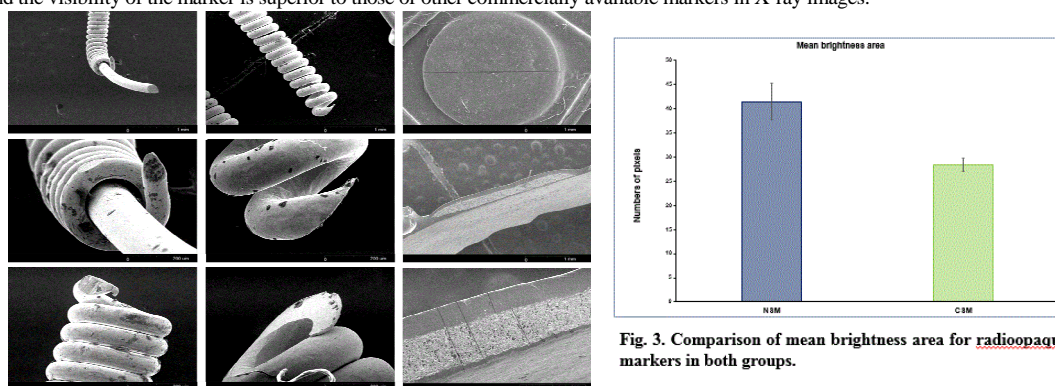


Fig. 3. Comparison of mean brightness area for radiopaque markers in both groups.

## Retrievable covered stents with a long lasso for benign bilioenteric strictures

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Endoscopic treatment of recurrent benign bilioenteric anastomotic strictures after biliary diversion surgery is challenging in clinical practice because a conventional endoscopic approach to the biliary orifice is difficult. Therefore, percutaneous balloon dilatation and prolonged catheter interposition have been used widely as alternatives to endoscopic treatment. Although a few recent studies describe percutaneous transhepatic placement and removal of a retrievable covered stent, the feasibility and safety of covered stent removal via a percutaneous transhepatic route needs to be studied further to obtain conclusive evidence in support of this approach. A 41-year-old woman underwent pylorus-preserving pancreaticoduodenectomy for duodenal cancer in 2015, and percutaneous balloon dilation with prolonged catheter interposition for a benign hepaticojejunostomy anastomotic stricture after failed endoscopic treatment in 2016. She developed jaundice secondary to a recurrent anastomotic stricture in 2017. We performed percutaneous transhepatic biliary drainage and obtained cholangiogram (Fig.a). The contrast medium did not flow to the jejunum because of a tight hepaticojejunostomy anastomotic stricture. Three days after percutaneous transhepatic drainage, she underwent percutaneous transhepatic placement of a 10×3-cm retrievable covered stent with a 50-cm-long distal lasso with five radiopaque markers (Fig.b). Before stent insertion, a 0.035-inch guidewire was advanced maximally distally from the anastomotic site for lasso deployment and to obtain enterography images (Fig.c). The lasso and stent were sequentially deployed (Fig.d,e). Radiographic images were obtained 1 day and 1, 2, 4, 8, and 12 weeks after the procedure to check for lasso distal tip and stent migration. Three months later, gastroscope was advanced to the afferent jejunal limb. The lasso was grasped using forceps, 80 cm from the incisors, and the stent was removed by retracting the forceps within the working channel (Fig.f,g). We percutaneously inserted a retrievable covered metal stent, which was removed endoscopically using a conventional gastroscope. She has not reported recurrent obstructive jaundice.

