

Evaluation of the Optimal Injection Solution in Hybrid Endoscopic Submucosal Dissection (ESD) for Various Organs in an *Ex Vivo* Porcine Model

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6UW_[fcibX. For flat and/or depressed lesions ranging from 11-20 mm, hybrid ESD, i.e., EMR with circumferential incision (CI), is now prevalent. However, there is no clear standard for choosing an injection solution. Sodium hyaluronate (SH) is often used, despite its disadvantages. This study aimed to clarify the most effective injection solution for safe hybrid ESD for trainees in various gastrointestinal tract organs.

AYh\cXg. CI was performed on 30 resected porcine esophagi, stomachs, duodena and colons. The following three solutions were injected into submucosa, and their ability to maintain mucosal elevation height (MEH) was evaluated: Solution A, normal saline (NS); Solution B, 1:1 mixture of NS and 0.4% SH; and Solution C, 0.4% SH. We measured the minimum snarable MEH and the average procedure time for snaring, and the optimal concentration of SH was identified both gcep®

perform hybrid ESD safely. Therefore, our second aim was to examine the correlation between the trainees' procedure time for snaring and the minimum snarable MEH and to optimize the concentration of SH required for successful hybrid ESD by trainees in various porcine organs. The present study examines the snaring method, which is safe and has minimal disadvantages; therefore, we did not focus on the difficulties in circumferential incision and instead highlighted the process after the circumferential incision.

Fujishiro et al. reported that performing controlled, reproducible MEH and precise MEH measurements in live pigs is very difficult; therefore, they conducted their studies on resected specimens [18]. This study used porcine organ specimens (esophagus, stomach, duodenum, and colon), acquired from a company that provides no human animal models for research, within 2 hours of resection to best simulate *in vivo* conditions. This study was granted an exemption from requiring ethics approval by the Institutional Animal Care and Use Committee of Teikyo University. Each specimen was stretched flat neutrally on a rubber board with pins, and the lesions were marked precisely with dots by tracing around the circumference of a 20-mm circular plastic plate (Figure 1A) using a Dual Knife (KD-650Q; Olympus Co., Tokyo, Japan) set at forced-coagulation mode (Effect3, 30 W) (ICC35Q, ERBE, Tübingen, Germany) (Figure 1B). To avoid the influence of solú TU



Figure 3 (A,B,C): Time course of mucosal elevation height (MEH) after

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For the stomach (Figure 5B), the minimum snarable height was 5.73 mm. If the MEH is lower than 5.73 mm, snaring cannot be performed (the gray shaded area in Figure 5B). In other words, when the MEH after the injection is higher than the minimum snarable MEH of 5.73 mm for the stomach, snaring can succeed. The graph indicates that with normal saline, snaring can be performed for approximately 60 seconds but that snaring cannot be performed at 90 seconds because MEH has decreased below 5.73 mm. For B, snaring can be performed for approximately 180 seconds, but at 300 seconds,

3 Ichikawa J, Tanabe S, Koizumi W, Kida Y, Imaizumi H, et al. (2003)