

## Automatic water irrigation synchronized with the electro-surgical unit: Bubble-free underwater endoscopic submucosal dissection

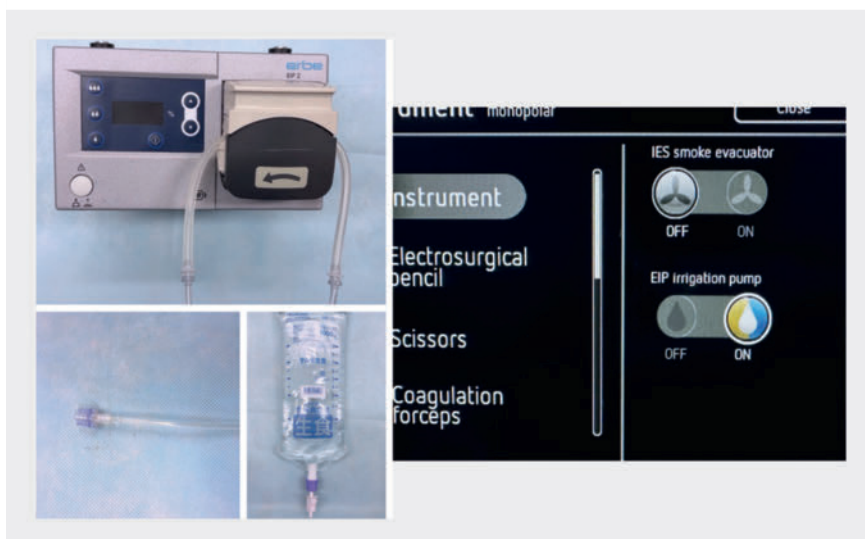
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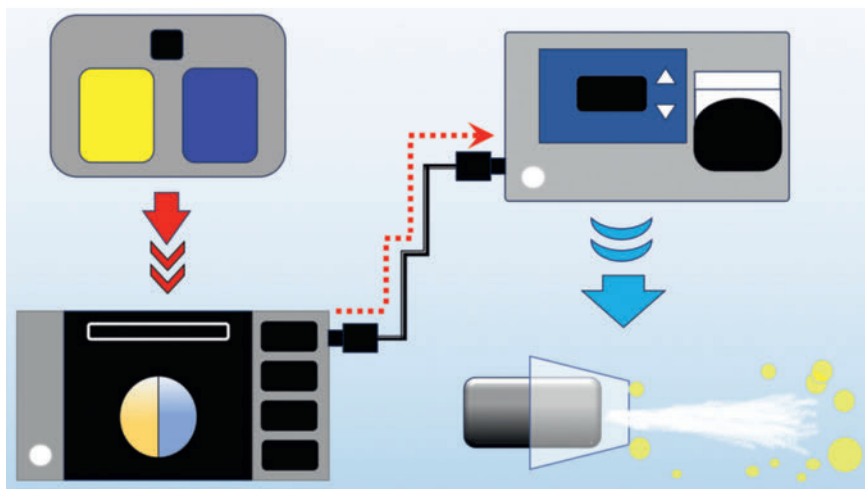
► **Fig. 1** Water irrigation pump (EIP2; Erbe, Tübingen, Germany).

The water pressure method is a underwater ESD technique, which facilitates direct visualization of the submucosa using a water stream through the waterjet channel of an endoscope [1]. This method significantly improves endoscopic exposure in difficult conditions such as the initiation of the submucosal dissection, dissection in a narrow space, and dissection of fibrotic tissue, and has been reported as useful for technically challenging ESD [2, 3, 4]. However, there is a problem in that the heat generated by the activation of the electro-surgical device at the lesion site creates bubbles in the water that often obstruct endoscopic visualization. In addition, especially when a tapered hood attachment is used, those bubbles are often trapped inside the attachment and are difficult to remove.

To solve this drawback, we have developed a modified underwater ESD technique that uses a water irrigation pump controlled synchronously with the activation from the electro-surgical unit. An endoscopic water irrigation pump (EIP2; Erbe, Tübingen, Germany) (► **Fig. 1**) is connected to the waterjet channel by a dedicated tube. This EIP2 pump also has a wired connection to the VIO3 electro-surgical unit (Erbe), that enables simultaneous activation of the pump and the VIO3 (► **Fig. 2**, ► **Fig. 3**). Water irrigation is done automatically when incision or coagulation currents are activated, thereby removing any generated bub-



► **Fig. 2** Preparation of the EIP2 water irrigation pump and setting of the VIO3 electro-surgical unit.

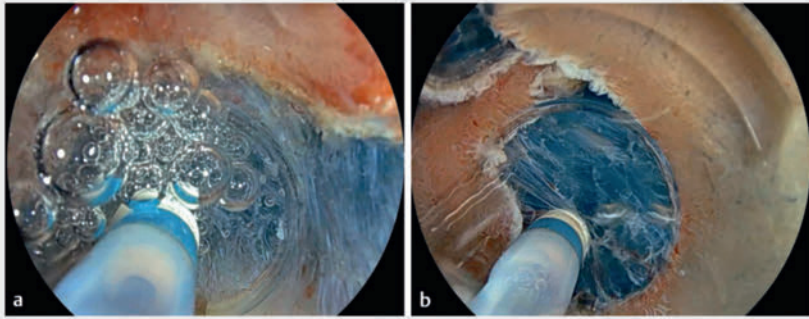


► **Fig. 3** Schematic of the automatic and synchronized water irrigation system.

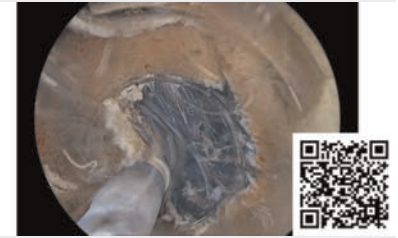
bles before they can be trapped in the hood attachment and enabling a continuously clear view for ESD performance (► **Fig. 4**, ► **Video 1**). We use the EIP2 with an output power of 50%–60%, but we recommend adjusting the power on a case-by case basis.

The bubbles generated during underwater ESD compromise endoscopic visibility, which may lead to loss of procedural precision. Our new technique, named “bubble-free underwater ESD,” can be a simple and practical solution.

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► **Fig. 4** Comparison of endoscopic image of bubbles inside the endoscopic tip attachment after 1 s of instrument activation. **a** Conventional underwater endoscopic submucosal dissection (underwater ESD) using the water pressure method. **b** Using the automatic synchronized water irrigation system (bubble-free underwater ESD).



► **Video 1** Bubble-free underwater endoscopic submucosal dissection (underwater ESD) using an automatic water irrigation system that synchronizes with an electro-surgical unit.

## Conflict of Interest

M. S and M. K received honoraria from Amco, Japan. The remaining authors have no conflicts of interest to disclose.

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