

DEVELOPMENT OF AN INTRACAVITARY PERFUSION DEVICE FOR LAPAROSCOPIC HEPATECTOMY WITH WATER-FILLED LAPAROENDOSCOPIC SURGERY (WAFLES): VALIDATION OF THE PROTOTYPE IN PORCINE DEVICE MODEL.

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Objective of the device:

Laparoscopic-assisted hepatectomy is one of the difficult surgery. Because the liver has a very rich blood supply, it is important to intraoperatively determine the hepatic vascular distribution for safe liver resection. Igarashi et al devised a Water-filled laparoendoscopic surgery (Wafles), reported in 2012. A method devised by us has enabled real-time ultrasonography, by applying the Wafles; this method allows secure grasping of the lesions and vascular distribution and determination of accurate resection lines. However, it may become impossible to secure an operative field if contamination occurs due to unexpected intraoperative bleeding. Therefore, we aimed to develop a Wafles device to be placed in the intracavity for securing an operative field.

Materials and Methods:

We created a perfusion environment for supply and drainage of artificial ascites by using a peristaltic pump, measured water pressure and water flow for supply, and installed a negative pressure sensor for drainage. Three 12-mm laparoscopic ports were inserted in a landrace/large white pig under general anesthesia, and after inducing pneumoperitoneum with carbon dioxide, about 1.5-L artificial ascites was replaced with saline (a mixture of air and liquid layers). Then, we performed the following: (1) observation of

the liver by using external and laparoscopic ultrasonography; (2) external and laparoscopic ultrasound-guided resection of the liver; and (3) confirmation of hemostasis with an energy device after angiotomy.

Results:

External and laparoscopic ultrasonography allows observation of the liver because the observation was mediated by saline, without contact of the laparoscope with the liver. Moreover, in liver resection, concomitant use of external and laparoscopic ultrasonography led to real-time confirmation of the hepatic blood vessels (water pressure, 0-230 mmHg; water flow, 0-1.9 L/min). For hemostasis after angiotomy, increased water flow led to securing of a critical view of safety (maximum water pressure, 300 mmHg; maximum water flow, 2.3 L/min).

Conclusions:

Laparoscopic hepatectomy by using the Waffles device is feasible. It is necessary to use a tool to minimize the artificial ascites in the future.