Method for Collecting Bile with a T-cannula in Unrestrained Conscious Beagles

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Abstract: Many experimental techniques for bile collection have been investigated. Most have been used under conditions of anaesthesia, or early after biliary cannulation. These conditions affect both the volume and the components of the bile, and the liver metabolism. In order to solve these problems, we devised an experimental method in which a T-cannula was introduced into the common bile duct of beagles that had been trained to remain at rest on the experimental table. Using this method, all of the bile could be collected under conscious conditions without the influence of surgical invasion.

Key words: beagles, bile collection, biliary cannulation

Many experimental techniques for bile collection in dogs have been investigated. Most have been used under conditions of anaesthesia, or early after biliary cannulation [3, 7, 9–12]. That anaesthesia affects hepatic blood flow [6], bile flow rate [8], bile pigment excretion [4] and metabolism [1, 8] is well known. Surgical invasion decreases bile flow and biliary lipid secretion. Four weeks are required for return to the normal condition following a bile duct operation [5]. In this study, we tested an experimental method which makes possible the collection of bile under conscious conditions without surgical invasion and therefore enables extension of the postoperative recovery period beyond four weeks.

Three female beagles 6 to 12 months of age (CSK Research Park, Inc.) were used in this study. They were kept in a barrier system room maintained at a temperature of 24 ± 2°C and a humidity of 50–60% with 12 hr of light and 12 hr of darkness. They were housed in individual stainless steel cages (670 mm × 670 mm × 675 mm) and fed a commercial diet (250 g/day) and tap water ad libitum. They were trained to stay at rest on the experimental table at least 4 weeks before the operation, and only well-trained animals (n=5) were used.

The method used for construction of the T-cannula was as follows. A T-drain II® (Kaneka Medix Corporation) was cut on both sides of the junction, and connected with silicone tubing (1.0 mm, i.d. and 2.0 mm, o.d., Kaneka Medix Corporation) which had a 1 mm diameter side hole. Surgical silk for fixation of the T-cannula to the subcutis was placed at a distance of 25 cm from the junction. A stopcock was connected to the terminal of the cannula (Fig. 1).

After a 24-hr fast, the beagles were anesthetized with thiopental sodium (Rabonale®, Tanabe Seiyaku Co.,

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Fig. 1. The T-cannula (A: T-drain II®, B: Silicon tubing, C: Surgical silk, D: Stopcock).

Fig. 2. Collecting bile from the unrestrained conscious beagle.

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Table 1. BSP Value (%) of Beagles

Anaesthesia was maintained with vaporized isoflurane (Forane®, Dainabot Co., Ltd.). Each animal was positioned dorsally recumbent. A midline incision was made in the upper abdominal cavity. The common bile duct was exposed by blunt dissection, and the T-cannula was inserted into it. The gall bladder was then removed, and a 4 Fr. nutrition tube (Atom Co., Ltd.) was inserted into the cystic duct. The cannula and the nutrition tube were passed subcutaneously to the right thorax, and the wound was closed by standard surgical techniques. Each animal was administered antibiotics (Tylocine®, Takeda Chemical Industries, Ltd.) daily for 5 days after the operation. Disinfection of the wound and flushing of the T-cannula and nutrition tube with saline were performed daily until the end of the study.

Body weight measurement and a liver function test (BSP test) were performed in the experimental procedure. Total daily bile outputs were measured three times in each animal between 4 and 8 weeks after the operation. The method of bile collection was as follows. The beagles at on the experimental table unrestrained and conscious, the extension tube was connected to the T-cannula, and the bile dripped spontaneuously into the measuring cylinder (Fig. 2). The dog was given food at 10:00 a.m. and water ad libitum while on the experimental table. In order to confirm the route of bile flow, contrast radiography was performed with the stopcock closed and also with it opened.

The body weight of each animal began to decrease slightly 1 to 2 weeks after the operation, but then returned to the preoperative level and remained normal. For one beagle, BSP was slightly increased at 4 weeks after the operation, but had returned to normal by 8 weeks after the operation (Table 1). The bile flowed smoothly, and the bile flow rate was 2.1–7.6 ml/hr. The total real volume of bile flow was 99.0 ± 12.2 ml/day. On radiographs, the bile was observed to flow into the duodenum when the stopcock was closed, and all of the bile flowed to the outside through the T-cannula when the stopcock was opened (Fig. 3).

These findings suggest that the recovery period can be extended beyond 4 weeks following the bile duct operation. We were thus able to set longer periods to keep the beagles in good health than with Takaichi and Nanbo's method [7]. The fact that the bile flowed into the duodenum when the stopcock was closed was the most important reason for this. This avoided hepatic disorder due to retention of the bile, and did not impair the digestive effects of the bile. Bile salts, the most important component of the bile, have an emulsifying action on ingested fat that promotes absorption of fatty acids and monoglycerides. In the absence of bile secretion, much of the dietary fat is not absorbed and
Fig. 3. Ventrodorsal radiographic view. A: When the stopcock of the T-cannula was closed, the bile filled the bile duct, and some of it flowed into the duodenum. B: When the stopcock was opened, all of the bile flowed to the outside through the T-cannula.

passes out in unusually fatty feces [2]. Our method therefore has little effect on digestive function.

In conclusion, we have described a very simple method for collecting bile under conscious conditions without surgical invasion.

References