



Emptying of the feline gallbladder after intravenous injection of histamine: An ultrasonographic study

Pražnjenje žučne kesice mačke posle intravenske injekcije histamina: ultrasonografska studija

Slobodan JANKOVIĆ, Ranka SAMARDŽIĆ, Dragan ČELIKOVIĆ, Dušan B. BELESILIN and Dragan MILOVANOVIĆ

Department of Pharmacology, Medical Faculty, Kragujevac and Department of Pharmacology, Medical Faculty, Belgrade

ABSTRACT. Gallbladder volume was measured by the method of real time sonography before and after intravenous injection of histamine in anaesthetized cats. A new mathematical model for calculating the gallbladder volume from ultrasonograph is proposed and the results were compared to the gallbladder volumes measured post mortem. These experiments also show that histamine stimulates the emptying of the feline gallbladder in vivo.

KEY WORDS: gallbladder, histamine, cat, ultrasonography.

SAŽETAK. Zapremina žučne kesice merena je pomoću aparata za dvodimenzionalnu ultrasonografiju pre i posle intravenske injekcije histamina kod anestetisanih mačaka. Priказан je nov matematički model za izračunavanje zapremine žučne kesice, i dobijeni rezultati su upoređeni sa volumenom žučne kesice izmerenim post mortem. U ovim eksperimentima je takođe pokazano da histamin pospešuje pražnjenje žučne kesice mačaka in vivo.

KLJUČNE REČI: žučna kesica, histamin, mačka, ultrazvuk

Most experimental data on the contractility of the gallbladder are derived from studies on dog, guinea-pig or human gallbladders in vitro, as well as in vivo (1 – 4). On the other hand, the experiments with the cat's gallbladder are scarce, and so far it seems that it has not been studied in vivo. In the present work, the anatomical shape and the histamine-induced contractility of the gallbladder in anaesthetized cats were examined by means of the ultrasonographic method. Currently used formulas for calculation of the human gallbladder volumes from ultrasonographs (5 – 7) were adapted to the specific anatomical shape of the feline gallbladder and the results were analyzed and compared to the gallbladder volumes measured during autopsy.

MATERIALS AND METHODS

Experimental procedure

Five cats of both sexes, weighing from 2.0 to 3.5 kg, after 24 hours starvation, were anesthetized with pentobarbital sodium (40 mg/kg i.p.). For intravenous injection of the drugs, left femoral vein was cannulated and immediately heparin (50 IU/kg b.w.) was injected intravenously. Right side of the thorax and abdomen was shaved and a water-bag 2 cm thick was interposed between the abdomen and the apparatus. Thereafter, 3–6 diameters of the transverse and of the longitudinal sections of the gallbladder

were measured by means of real-time sonography (3 MHz, Squibb-Ultramarc 4). Maximal longitudinal and transverse diameters of the gallbladders from each section were measured by the sonography apparatus itself before, as well as after the intravenous injections of histamine.

Subsequently, the cats were sacrificed by intravenous air bolus injection. After laparotomy, ductus cysticus was clamped and the whole liver together with the gallbladder was taken out. The content of the gallbladder was removed with a syringe and its volume was measured. Then, the gallbladder was filled with water through the same needle until the appearance of the first sign of resistance, and the volume of the instilled water was recorded.

Calculation of the gallbladder volume

Currently used formulas for calculation of the gallbladder volumes were developed on the basis of the approximation of the anatomical shape of the gallbladder to a cone (6) or to an ellipsoid (7).

Volume of the "cone-like" gallbladder (6):

$$V = 1/3 \times \pi \times L \times R^2$$

($\pi = 3.14$; L = maximal longitudinal diameter of the longitudinal section, R = half of the maximal transverse diameter on the transverse section).

Volume of the "ellipsoid-like" gallbladder (7):

$$V = 1/6 \times \pi \times L \times W \times H$$

($\pi = 3.14$; L = maximal longitudinal diameter on the longitudinal section; W = maximal width and H = maximal height of the transverse section).

Volume of the feline gallbladder:

According to our observations, the anatomical shape of the feline gallbladder looks like a cone with a hemisphere attached to its base (Figure 1, 2). Thus, its volume can be calculated as follows:

$$V = 1/24 \times \pi \times D^2 \times (D + 2L)$$

(D = maximal transverse diameter on longitudinal section, L = maximal longitudinal diameter on longitudinal section)

Since the cone-like part of the feline gallbladder is more oval than the cone itself, the volume is increased by 15%:

$$V = 1/24 \times \pi \times D^2 \times (D + 2L) \times 1.15$$

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