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A New Method for Permanent Catheterisation in the Dog

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Summary. A new method of enabling urodynamic measurements to be made in the conscious dog is reported. A connecting device is located under the skin on the dog's back, and a catheter passes between this device and the bladder. The system described has proved valuable.

Key words: Experimental, Catheterisation, Dog.

Introduction

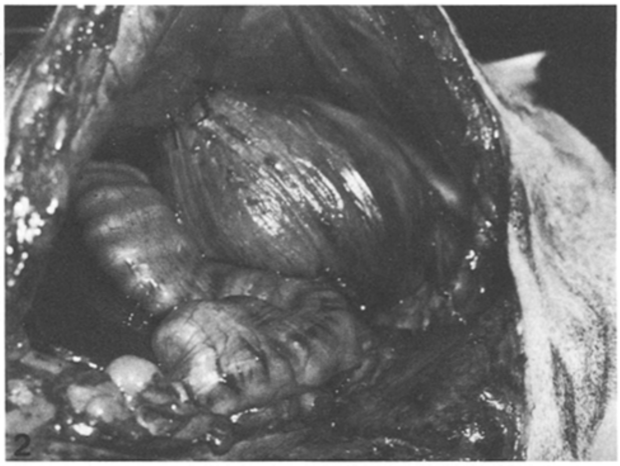
In the animal model, the mechanical properties of bladder muscle have been studied extensively in vitro [1].

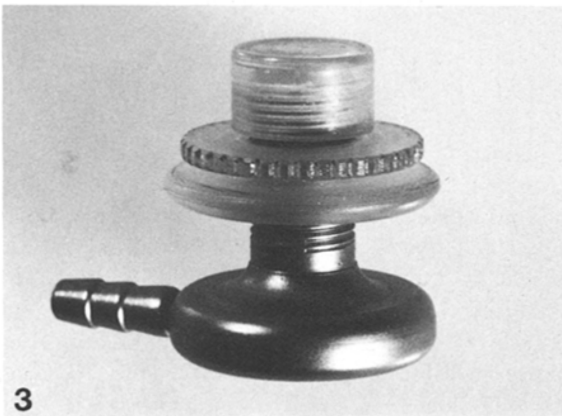
For urodynamic studies in vivo in the non-anaesthetised animal, catheterisation of the bladder is a major problem. Magasi introduced an experimental subvesical obstruction in dogs and observed a decreased flow, but no pressure-flow studies are reported [2]. Similarly, the experimental neurogenic bladder disorders introduced in rabbits by Pompino and Oerthel Haid were not monitored by urodynamic studies, although a chronically high intravesical pressure was mentioned [3]. Pelvic nerve stimulation and drug responses on urethra and bladder were recorded in anaesthetised female dogs [4]. In the rabbit model, urodynamic studies were performed when the animal was restrained on an animal board [5]. In other experiments, rabbits were anaesthetised when bladder pressure studies were done [6–9]. The anaesthetic agents, however, have a marked influence on the urodynamic findings [10]. To avoid the effect of anaesthesia and stress, a method of introducing a permanent indwelling catheter was developed, permitting reproducible urodynamic studies in dogs.

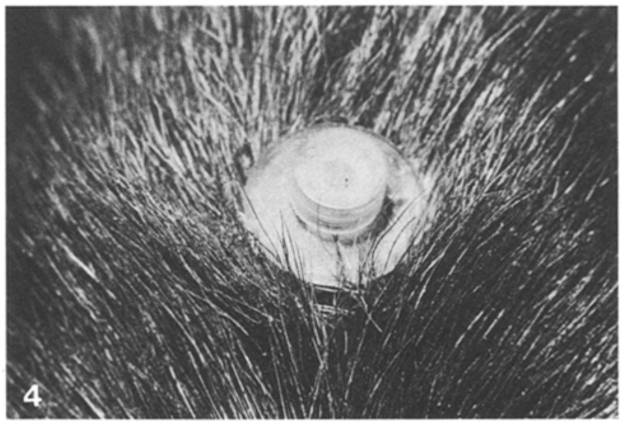
In the dog, the bladder is located almost completely intraperitoneally. The contracted bladder is restricted to the pelvic cavity and the distended bladder passes cranially into the umbilical region [11, 12]. The occasional observation at autopsy of tight uracheal remnants between the bladder dome and umbilicus led us to consider making an artificial connection between the bladder and abdominal wall. A permanent catheter could be introduced through this connection. Secondly, a device had to be developed permitting a catheter to emerge through the skin without the risk of falling out or being removed by the animal. We required that the catheter should be available without any preparation and that it could be connected to infusion or pressure lines without disturbing the animal. After some pilot studies involving several modifications, the following method was developed.

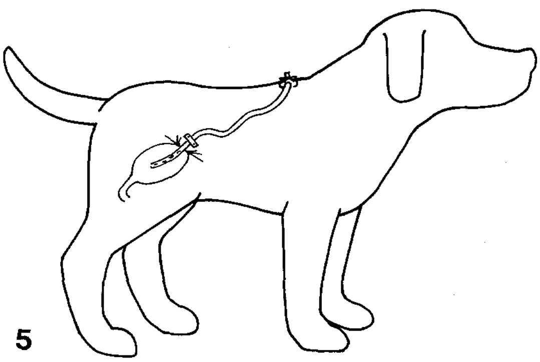
Materials and Methods

Healthy male beagle dogs, weighing between 12 and 17 kilograms, were used. Anaesthesia was induced by intravenous injection of pentobarbital and maintained with nitrous oxide through an endotracheal tube. The dog was placed in the supine position. After shaving and preparing the abdominal wall, a midline incision was made to expose the abdominal cavity. The bladder was emptied by needle puncture. A 12 F polyethylene catheter was introduced in the dome of the bladder and secured with a purse string suture. After choosing the place for fixation of the bladder, a stab wound was made through the right laterodorsal abdominal wall. The catheter was passed through this wound, pulling the bladder to the parietal wall and the bladder was fixed in this position by 4–5 sutures (Fig. 1, 2). In this way, a watertight connection was made without the risk of urine leakage into the abdominal cavity. At this stage the bladder could be filled and emptied through the catheter to check its freedom of movement. After securing the catheter in the muscle of the abdominal wall, the midline incision was closed with two layers of interrupted silk sutures. The dog was then moved onto its left side. An incision was made in the skin of the animals back between the shoulder blades. A specially designed stainless steel connecting device was introduced subcutaneously via this incision and partially exposed through a second stab wound (Fig. 3). The connecting device could then be assembled (Fig. 4). With a long forceps, a tunnel was made through the loose subcutaneous tissue and the end of the catheter was pulled up to the cranial incision. After adjustment of the catheter length so that the animal would be able to move freely, the catheter was connected with the device. The skin incisions were closed with 2 x 0 silk. Figure 5 shows a schematic drawing of the final situation.









Figs. 1, 2. Fixation of the bladder to the abdominal wall

Fig. 3. Connecting device for catheter

Fig. 4. Connecting device 3 months after implantation

Fig. 5. Schematic drawing of indwelling catheter

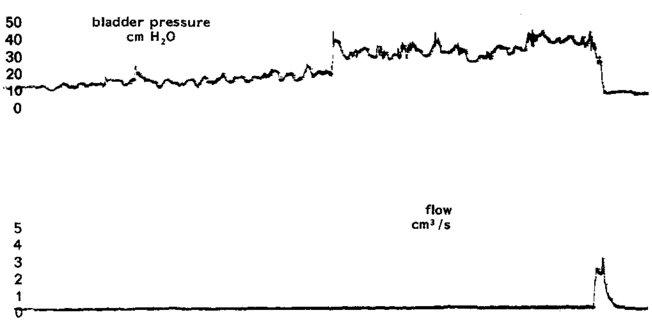


Fig. 6. Pressure-flow study

Results

A permanent indwelling catheter was introduced in dogs, allowing urine sampling, bladder washing and pressure-flow studies for various purposes. The cap of the connecting device could be simply taken off and an infusion line, a pressure line or a syringe connected. After finishing the experiment the cap could be replaced. Fig. 6 shows an example of a pressure-flow study. In two of the dogs, studies were done after administration of different drugs. The other dogs were studied after introducing a subvesical obstruction in a second operation. The connecting device allowed frequent pressure-flow studies in order to examine changes in the behaviour of the detrusor. The dogs very soon became accustomed to these experiments. The results of this study are to be published later. The indwelling catheters were removed after 3–6 months. Bacterial infection was not seen in the animals without subvesical obstruction, but was certainly present in some of the cases with a subvesical obstruction. Stone formation was observed round the catheter after 3 months when there was subvesical obstruction and infection. No attempt was made to prevent infection or stone formation by bladder washing through the catheter.

Discussion

A successful experimental model of introducing a long term indwelling catheter has been created in beagles. This method provides an easily connectable permanent catheter to the bladder. Urine samples can be withdrawn and bladder washing can be performed through the connecting device. Pressure-flow studies can be performed in the conscious dog, eliminating the effects of anaesthesia and stress. Suitably adapted, this method may provide a valuable model for those involved in experimental urodynamics.

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