Short Report

Conduction Velocity in Various Regions of the Renal Pelvis and Ureter

TAKASHI MORITA, GENZO ISHIZUKA, TAKASHI SUZUKI, SHUN KONDO and SEIGI TSUCHIDA

Department of Urology,* Akita University School of Medicine, Akita 010

MORITA, T., ISHIZUKA, G., SUZUKI, T., KONDO, S. and TSUCHIDA, S. Conduction Velocity in Various Regions of the Renal Pelvis and Ureter. Tohoku J. exp. Med., 1983, 141 (2), 245-246 — Conduction velocity of excitation in various regions of the canine pelviureter was studied through the simultaneous recordings of electromyograms at four sites of the canine pelvicalyceal preparation. The pelviureteral system was maintained in the condition which was similar to in vivo situation by infusion of oxygenated Krebs-Ringer solution into the renal pelvis at the average flow rate of living dogs. The conduction velocity was slowest in the proximal region of the pelvis where the pacemaker was located, i.e., about 5.8 mm/sec on an average. The velocity gradually increased in the distal region of the pelvis and the ureter. It was suggested that the conduction velocity of excitation was significantly different in the proximal area of the pelvis, the distal area of the pelvis and the ureter. — conduction velocity; pacemaker potential; renal pelvis; ureter

Bozler (1942), in his pioneer work on the ureter, found the pacemaker of the ureteral peristalsis in its renal end. Kobayashi (1964) found that action potentials were generated at a rate of 4-8/min from the upper region of the cat renal pelvis and were conducted toward the ureter. He also reported that the conduction velocity was very slow in the pelvis and gradually increased with distance from the pelvis in the ureteral region. Kobayashi (1964) employed an in vitro method without urinary excretion into the renal pelvis. It is well-known that the ureteral peristalsis is influenced by the urine flow rate. Although, it is impossible to measure the conduction velocity in the living renal pelvis with urine flow. Then in this study an in vitro method was utilized which enabled the simulation of urine excretion by the continuous intrapelvic infusion of oxygenated Krebs-Ringer solution into the atraumatically resected canine pelvis and ureter. Using this model simultaneous recordings were made of electromyograms from various regions of the renal pelvis and ureter, in order to examine the conduction velocity of the renal pelvic pacemaker potential in the pelvis and ureter.

The kidney and ureter were removed carefully in five anesthetized mongrel dogs. The renal parenchyma and fatty tissue concealing the renal pelvis and calyces were removed so as not to perforate the pelvis or calyces in oxygenated Krebs-Ringer solution. After exposing the renal pelvis and calyces of the dorsal side, a No. 4 Fr. polyethylene catheter was inserted through the parenchyma into the renal pelvis. The pelviureteral preparation placed in an oxygenated Krebs-Ringer solution at 37°C was infused with the same solution through the catheter using an infusion pump at a flow rate of 0.80 ml/min, which was equivalent to normal urine flow in living dogs. As shown in Fig. 1, four microglasselectrodes were placed on the pelvicalyceal border (PC-border), the pelvic center, pelviureteral junction (PUJ) and the ureter away 6.0 mm from the PUJ to record action potentials. The

Received for publication, March 19, 1983.

* Director: Prof. S. Tsuchida.
The conduction velocity was obtained by the distance between the two electrodes divided by the time interval between the peaks of the two potentials, and averaged in the ten preparations.

The potentials of about 20 µV with a constant discharge interval recorded at the PC-border showed a slow rising wave form, very similar to Kobayashi's recording (1964). At the pelvic center, PUJ and the ureter, sharp peaked potentials of 60~1000 µV amplitude were recorded with a multiple discharge interval of the discharge interval at the PC-border, as shown in Fig. 2. The conduction velocity was found to be very slow, i.e. about 5.8 mm/sec on an average in the proximal region of the pelvis. The velocity in the distal region of the pelvis was 14.4 mm/sec on an average, in the proximal ureter 20.0 mm/sec. The velocity obtained in this study was faster than that recorded by Kobayashi (1964) in the cat pelvis and ureter. The reason may be that our preparation is infused with the solution into the renal pelvis, equivalent to the normal urine excretion, in contrast to the preparation by Kobayashi (1964) without urine excretion. There may be the species difference between the cat and the dog. It was proved that the pacemaker potential initiated at the PC-border is propagated to the ureter, increasing the conduction velocity gradually.

References