A New in Vivo Method of Recording of the Electrical Activities of the Renal Pelvis

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TSUCHIDA, S., MORITA, T. and KONDO, S. A New in Vivo Method of Recording of the Electrical Activities of the Renal Pelvis. Tohoku J. exp. Med., 1982, 136 (2), 233-234 — A new method is described which enables in vivo recording of electromyogram from the pelvicalyceal border (PC border) of the canine renal pelvis. At the PC border slow rising-potentials with constant intervals are recorded throughout the normo-uretic stage and the diuretic stage. The waveform of the discharge is very similar to that of the pacemaker potential obtained by the previous in vitro study. — pelvic electromyogram; pacemaker of ureteral peristalsis; in vivo experiment

Recently, we have proposed a new in vitro method to record electrical activities of the pacemaker of ureteral peristalsis using a removed canine kidney and ureter during continuous intrapelvic infusion of oxygenated Krebs-Ringer solution at the same rate as that of normal urine secretion (Tsuchida et al. 1978). However, the in vitro method has a few problems about oxygenation of the removed kidney and ureter and artificial intrapelvic infusion. Therefore it is unclear that the results obtained by our in vitro experiments exactly represent canine pelvic peristalsis in vivo. As a solution for these problems, the present paper describes an in vivo method for recording of electromyograms from the renal pelvis and the ureter.

Mongrel dogs were anesthetized with an intravenous injection of thiamylal sodium (15 mg/kg), and the kidney was exposed carefully through an abdominal median incision. After removal of perirenal fat, the pelvis behind the renal artery and vein was faced to anterior by rotating the kidney. The kidney was lifted up from the posterior abdominal wall and fixed by a three nailed clamp to prevent mechanical artifact due to respiratory movement. To expose the intrarenal pelvis, an incision in renal parenchyme concealing the pelvis by the Gil-Vernet method was employed. A suction glass electrode, 0.5 mm in diameter enclosing a platinum line, 0.3 mm in diameter was gently put upon the PC border of the exposed renal pelvis. The potentials were amplified with an A-C biophysical amplifier (time constant 0.01 sec, hicut 15 Hz), and recorded on a 4-channel biophysical polygraph (Nihon Kohden Co.). In addition, electrical impulses from the renal artery were put into the negative pole of the microelectrode to negate the mechanical artifact due to pulsation. Fig. 1 diagrammatically shows the experimental arrangement of this method.

As shown in Fig. 2, simultaneous recording of action potentials from the PC border and the ureter can be achieved before and after administration of furosemide (0.05 mg/kg). At the PC border, the discharge interval of the electromyogram was constant throughout the normo-uretic stage and the diuretic stage. Electromyogram form of the PC border showed slow rising-positive spikes, with an amplitude of approximately 10 µV, duration of approximately 3 sec and no initial negative deviation. The electromyogram was very

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similar to that recorded by the in vitro method reported previously (Tsuchida et al. 1978). At the lower pelvis, pelviureteric junction and ureter, the discharge intervals became shorter in the diuretic stage than in the normo-uretic stage and was an integral multiple of the discharge interval at the upper pelvis. These findings indicate that the discharge recorded from the PC border is the pacemaker potential. To our knowledge, this is the first successful trial of the in vivo recording of pacemaker potential.

Reference