Hypothesis

Underactive bladder (UAB) has been described as a symptom complex suggestive of detrusor underactivity (DU) that is usually characterized by prolonged urinary time with or without a sensation of incomplete bladder emptying, usually with hesitancy, reduced sensation on filling, and slow stream [1]. Diabetes mellitus (DM) is one of the causes of the UAB, and streptozotocin (STZ) induced DM rats has been widely used as an animal model of UAB [2]. Diabetic bladders may undergo a transition from a compensated to a decompensated state [3], but this time point has not been fully investigated. The aims of this study are to assess the time-dependent changes in vitro bladder functional changes and to characterize lower urinary tract dysfunction in the STZ-induced diabetic rats.

Materials & Methods

Male Wistar rats (9 weeks old) were received intra-peritoneal injection of 60 mg/kg of STZ.

• In vitro muscle strip experiments (at 4, 8, 12, 16-weeks)
  ✓ full-thickness of longitudinal strips (bladder body)
  ✓ contractile responses to
  ✓ high potassium chloride (high K+ - 62 mM)
  ✓ electrical field stimulation (EFS: 2-6 Hz, 50 V, 0.8 msec pulse duration, 5 s train duration, 2 min interval)

• In vivo cystometry (CMG; at 16-weeks)
  ✓ under conscious and restraint condition
  ✓ single CMG measurements (at 2 days after a catheter-implantation)
  ✓ saline-institution at a rate of 0.5 ml/hour
  ✓ Three micturition cycles were averaged.

• In vivo simultaneous recordings of bladder pressure under an isovolumetric condition and urethral perfusion pressure (UPP) (at 16-weeks) [4-6] (Figure 1)
  ✓ under urethane-anesthetized condition (1.0 mg/kg subcutaneously)
  ✓ ligation of the ureters and bladder neck
  ✓ A bladder catheter and a double lumen urethral catheter were inserted separately.

Results


Diabetic rats

• higher serum glucose level and bladder weight, and lower body weight at all time points (4, 8, 12, and 16 weeks)

• contractile responses to
  ✓ high K⁺
  ✓ EFS: tended to be higher at 4, 8, 12 weeks, reversed at 16 weeks (Figure 2B)

• CMG measurements (Table 1 and Figure 3)
  ✓ higher voided volume, residual volume, bladder capacity, maximal voiding pressure, and the amplitude and frequency of NVCs

• CMG measurements suggested
  ✓ diabetic bladder dysfunction as a model of UAB occurs at least more than 16 weeks after induction of DM by STZ

• In vivo CMG measurements suggested
  ✓ diabetic bladder dysfunction is relatively limited, but rather urethral relaxation during voiding could be impaired at a late phase of DM induced by STZ

Discussion

The present results suggest that diabetic bladder dysfunction as a model of UAB occurs at least more than 16 weeks after DM-induction by STZ-injection. In addition, the present results indicate urethral relaxation failure rather than bladder dysfunction during voiding is possibly prominent in the chronic diabetic animal model induced by STZ.

Conclusions


References