#652 Comparison of the effects of two anesthetics, isoflurane and urethane, on bladder function in rats

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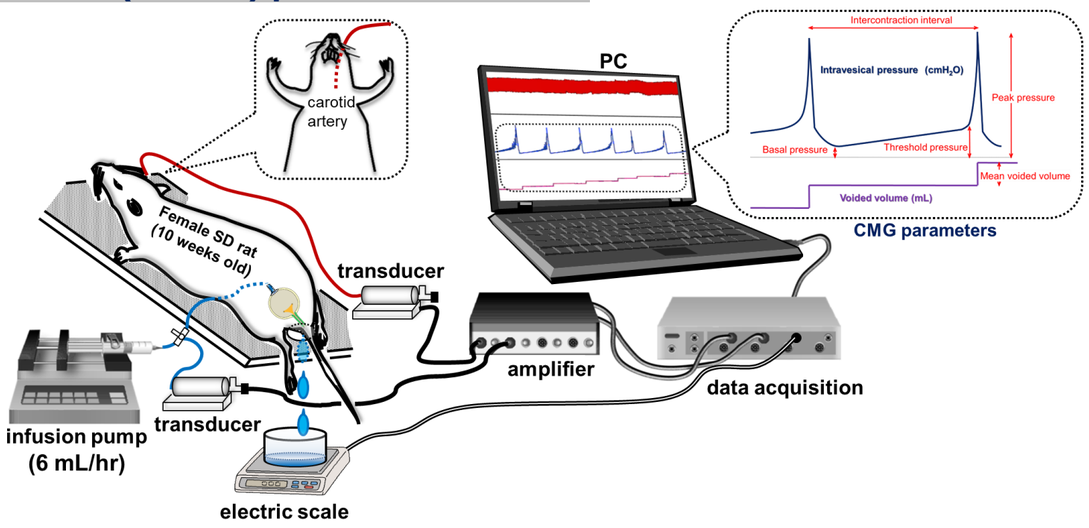
Hypothesis / Aims of study

Urethane is the most suitable anesthetic for acute and chronic experiments of the lower urinary tract that require demonstration of the micturition reflex in rodents because, although there are some changes in bladder function, the micturition reflex is not suppressed (Matsuura and Downie. Neurourol Urodyn. 2000;19(1): 87-99). Meanwhile, isoflurane exhibits significant suppression of external urethral sphincter–electromyogram activity and prolonged suppression of the micturition reflex compared with urethane (Chang and Havton. Am J Physiol Renal Physiol. 2008;295(4): F1248-1253). However, there have not been studies that directly compare the effects of isoflurane and urethane on bladder function. In the present study, we compared the effects of two anesthetics, isoflurane and urethane on bladder function in rats. Arterial pressure, cystometry (CMG), and rhythmic bladder contractions (RBCs) under isovolumetric conditions, mechanosensitive single-unit afferent activities (SAAs), bladder compliance and bladder myogenic microcontractions (bladder microcontractions), bladder blood flow, and blood and urine biochemical tests were investigated in isoflurane- or urethane-anesthetized female rats.

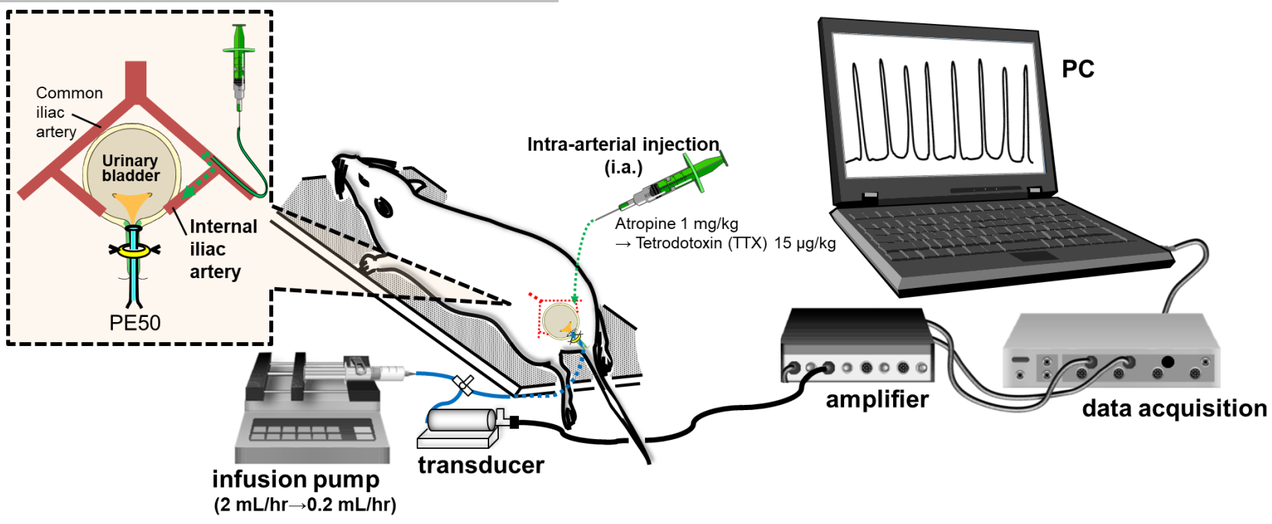
Materials and Methods

Isoflurane anesthesia: initiation：5%, surgery：1.5-2%, measurement：1.1-1.3%（room air）
Urethane anesthesia: 1.2 g/kg, i.p.

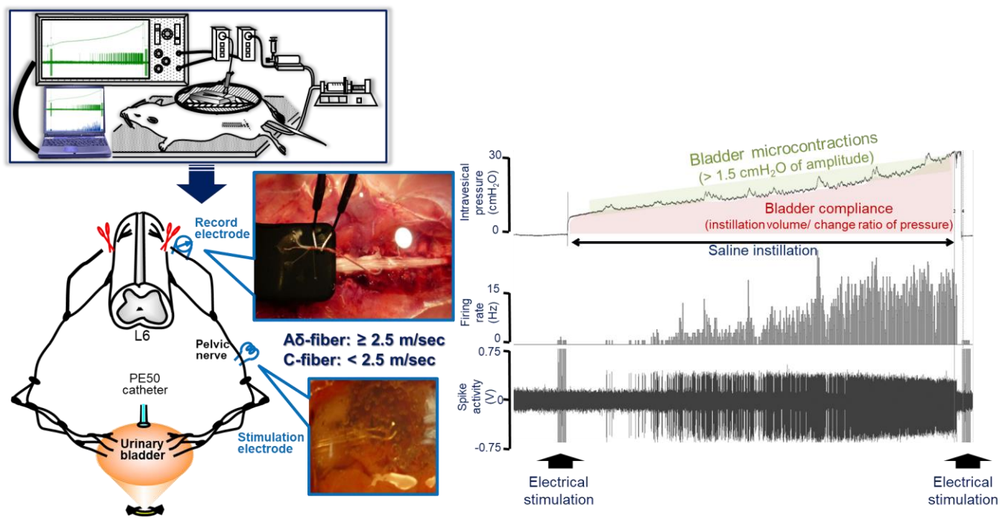
▪Blood (arterial) pressure and CMG



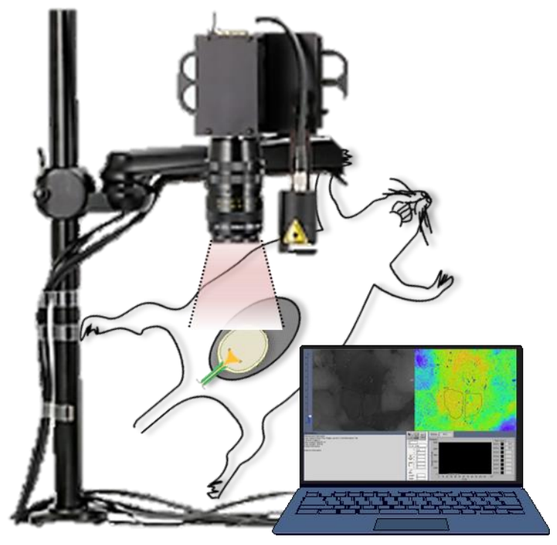
▪RBCs under isovolumetric condition



▪SAAs measurement



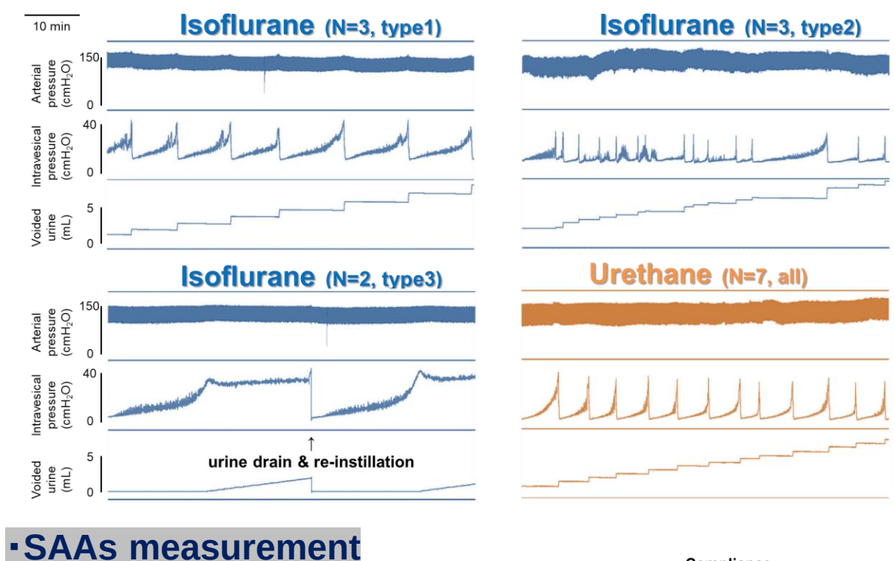
▪Bladder blood flow measurement



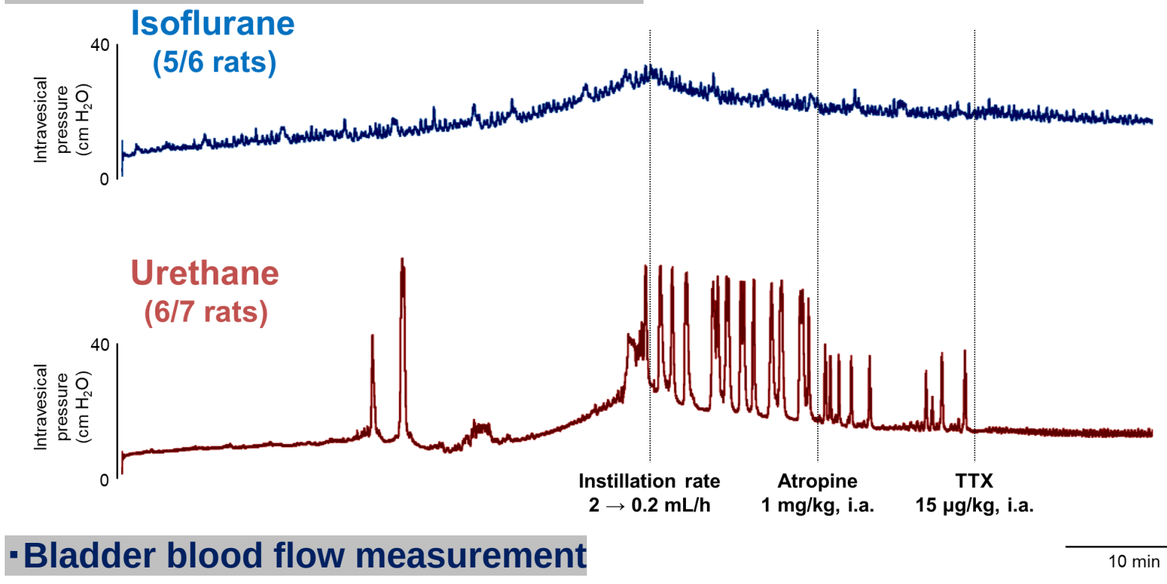
▪Biological chemical tests of serum and urine samples

Results

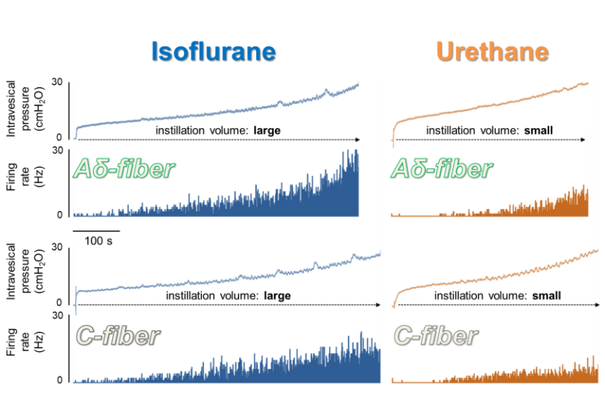
▪Blood (arterial) pressure and CMG

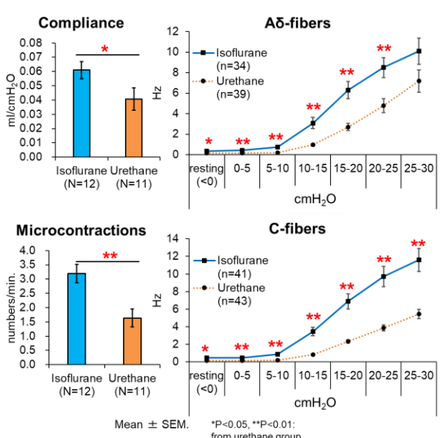


▪RBCs under isovolumetric condition

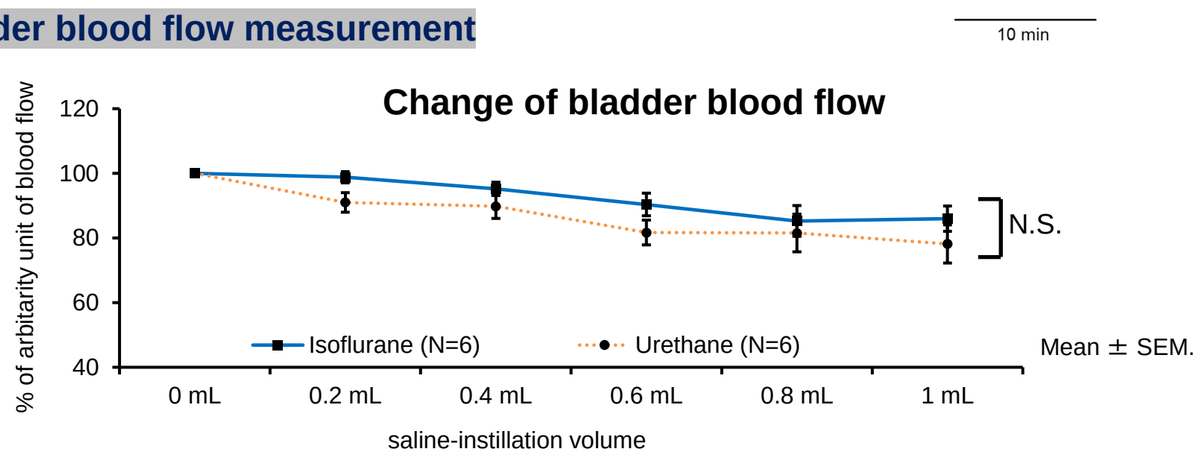


▪SAAs measurement

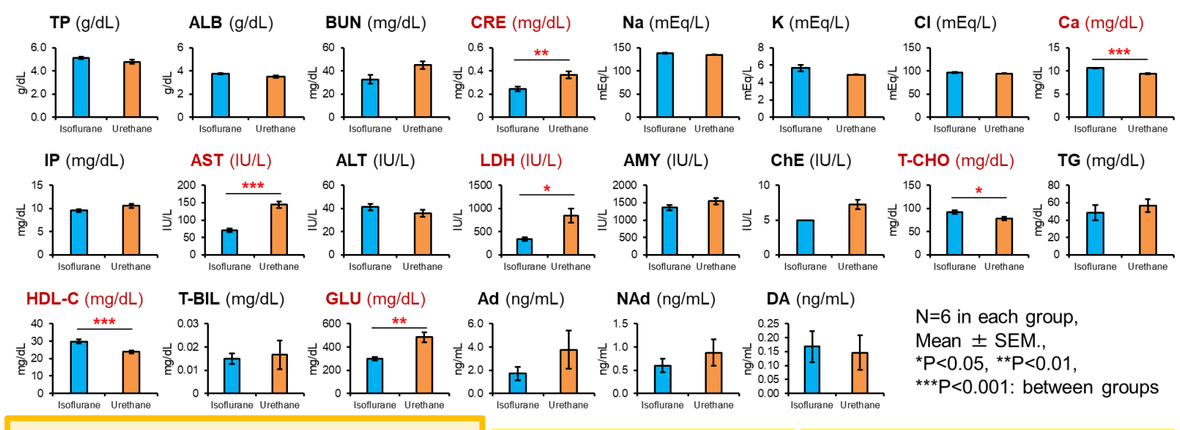




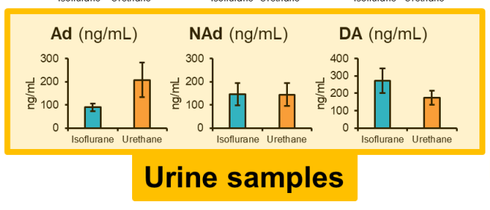
▪Bladder blood flow measurement



▪Biological chemical tests of serum and urine samples



N=6 in each group,
Mean ± SEM.,
*P<0.05, **P<0.01,
***P<0.001: between groups



Urine samples

Isoflurane > Urethane
- **Ca** (calcium)
- **T-CHO** (total-cholesterol)
- **HDL-C** (high-density lipoprotein cholesterol)

Isoflurane < Urethane
- **CRE** (creatinine)
- **AST** (aspartate aminotransferase)
- **LDH** (lactate dehydrogenase)
- **GLU** (glucose)

▪Summary of results

anesthetic	Voiding contraction for micturition	During storage phase: compliance	During storage phase: micro-contractions	During storage phase: afferent activities	Arterial pressure	Bladder blood flow	Biochemical data: Serum	Biochemical data: Urine
Isoflurane	suppressed	higher			—	—	Higher of • Ca • T-CHO • HDL-C	—
Urethane	spared	lower			—	—	Higher of • CRE • AST • LDH • GLU	—

— : no difference between groups

Isoflurane: storage function > voiding function

Urethane: voiding function > storage function

Discussion and Conclusions

The present study showed that urethane anesthesia retains bladder neurogenic contractions for micturition, whereas isoflurane anesthesia attenuated these contractions. However, bladder compliance, bladder myogenic microcontractions, and the mechanosensitive afferent activities of Aδ- and C-fibers during the storage phase were retained under isoflurane anesthesia, but attenuated under urethane anesthesia.

Isoflurane anesthesia is useful for pharmacological and physiological investigations regarding the bladder function during the storage phase, while urethane anesthesia is useful for those regarding the bladder contractions for micturition.