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Lee T[1], Yoon S M[1], Jin L[1], Kwon Y[1], Lee D H[2]

***1.*** *Dept of Urology, Inha University Hospital, Incheon, Korea,* ***2.*** *The Catholic University of Korea Our Lady of Mercy Hospital*

# AN APPROPRIATE CONTROL RAT TO SPONTANEOUS HYPERTENSIVE RAT FOR THE AWAKE STUDY OF DETRUSOR OVERACTIVITY: BASED ON THE SIMULTANEOUS REGISTRATION WITH INTRAABDOMINAL AND INTRAVESICAL PRESSURES

Hypothesis / aims of study

The spontaneous hypertensive rats (SHRs) have been widely used as the animal models for not only hypertension but also the other diseases such as stroke, anxiety, attention-deficit hyperactivity disorder and detrusor overactivity (DO) in lower urinary tract, because they have a variety of confounding phenotypic characteristics.[1]

The aim of this study was to investigate which animal model is appropriate as a control animal to SHR in the study related to DO, in views of the objective report of DO by abdominal pressure as well as the conventional pressure/ volume parameters of their awake cystometries.

Study design, materials and methods

Age-matched 10 SHRs, 9 Wistar-Kyoto (WKY) rats, 10 Wistar-ST (WST) rats, and 10 Sprague-Dawley (SD) rats were included in this study. A balloon-fitted catheter was positioned in the abdominal cavity to record the IAP. Conventional urodynamic pressure- and volume-related parameters and DO-related ones during filling phase were investigated.

Among the intravesical pressure rises (IVPRs) above 2 cm$H_2O$, DO was defined as IVPRs without simultaneous changes in IAP, and counted during filling phase.

Results

**Pressure parameters –** There showed no significant differences among those four groups except the threshold Pressures (data not shown).

**Volume parameters -** Compared to SHRs, only WST group showed significant increase in bladder capacity, micturition volume, and micturition interval.

**DO parameters** – DO was seen in SHR during filling phases, not WST and SD (Table 1).

However, WKY showed the similar frequency and pressure of DO to those of SHRs (Table 1, Fig. 1).

Interpretation of results

Although WKY rats function as an appropriate control to SHR for hypertension studies, these may be inappropriate as controls for the studies related to DO because they have inherent DOs similar to SHR.

And WST rats may be inappropriate controls for the studies related to voiding dysfunction, because they have inherent larger capacity comparing to SHR.

Considering the pressure, volume and DO parameters, SD rat is the most appropriate control to SHR for the DO studies.

Concluding message

Although WKY rats are from the colony in Kyoto from which the SHR strain was derived, the biological variability between them may be significantly different in respective phenotypic characteristics owing to the different breeding technique and mechanisms in different companies.[2]

Thus if we want to use these rats as controls to SHR focused on DO model, our hypothesis need to be tested in view of the parameters relating to DO as well as pressure/ volume of bladder.

TABLE 1.Cystometric volume and DO-related parameters in awake, freely moving SHR, WKY, WST and SD rats.

| | BC mL | MV mL | RV mL | MI $min^{-1}$ | Time of Filling Phase.$min^{-1}$ | Frequency of DO.$min^{-1}$ |
|---|---|---|---|---|---|---|
| SHR(n=10) | 1.19±0.11 | 1.16±0.11 | 0.03±0.02 | 7.17±0.71 | 6.64±0.72 | 1.7±0.5 |
| WKY(n=9) | 1.46±0.11‡‡ | 1.44±0.11‡‡ | 0.01±0.01 | 8.62±0.63‡‡ | 8.15±0.63‡‡ | 2.1±0.3 |
| WST(n=10) | 2.56±0.29*‡ | 2.42±0.26*‡ | 0.15±0.06 | 15.36±1.60** | 14.82±1.56** | 0**†† |
| SD(n=10) | 1.56±0.14‡‡ | 1.55±0.15‡‡ | 0‡‡ | 9.25±0.9‡‡ | 7.83±0.50‡‡ | 0**†† |

BP: Basal Pressure, TP: Threshold Pressure, MP: Micturition Pressure, BC: Bladder Capacity, MV: Micturition Volume, RV: Residual Volume, M.I.: micturition interval, IVP: Intra-vesical pressure, DP: Detrusor pressure. Results are expressed as mean ± standard error of the mean. *****p < 0.05, ******p < 0.01 (unpaired Student's *t* test), versus SHR; †p < 0.05, ††p < 0.01 (unpaired Student's *t* test), versus WKY.; ‡p < 0.05, ‡‡p < 0.01 (unpaired Student's *t* test), versus WST.

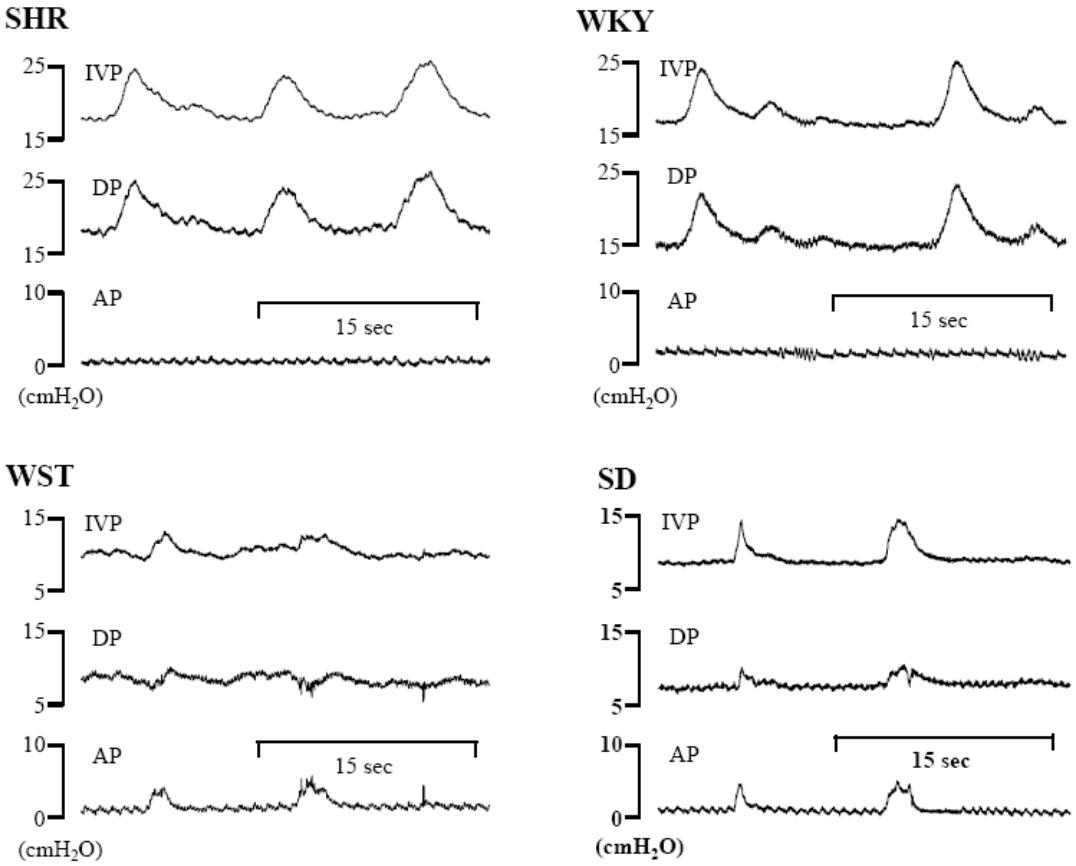


**Fig. 1. Detrusor overactivity (DO) and abdominal straining (AS) in awake rat cystometry. WKY showed the typical DO similar to SHR. WST and SD showed not DO, but AS during filling phases.**


References

1. Clin Exp Pharmacol Physiol 1999 26:568-572
2. Hypertension 1987 10;1:127-131



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| ***Is this a clinical trial?*** | **No** |
| ***What were the subjects in the study?*** | **ANIMAL** |
| ***Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?*** | **Yes** |
| ***Name of ethics committee*** | **Inha University Animal Ethic Committee** |