

Suture to close part of the urinary meatus: a novel animal model of bladder outlet obstruction

Lin C¹, Jin Y¹, Yafei Y¹, Pinglin H¹, Haifeng H¹, Shasha X², Yamei Z²

(¹Department of Urology; ²Central Laboratory, Affiliated Hospital of Chengdu University, Chengdu 610081, China.
E-mail: clin360@gmail.com)

Purpose: Open surgery are the most common methodological approach to create partial bladder outlet obstruction (pBOO) animal model. Surgical suturing to close part of external urethral orifice is hypothesized to induce comparable pathophysiological changes in bladder and renal function, while the optimum degree of obstruction that can closely mimic pathology observed of pBOO in clinic remain to be elucidated. We aimed at testing this concept by performing a comprehensive time-dependent analysis of stability and reliability in this novel animal model.

Materials and Methods: Six to 8-week-old female BALB/c mice were divided into a three groups according to the degree of external urethral orifice stenosis (EUOS), non-operated mice served as controls, pBOO model created by traditional method were used as positive control (Figure 1). In EUOS groups, the pediatric venous indwelling catheter was used for urethral catheterization, and then the needle for suture was entering the urinary meatus at the 3 o'clock position. We withdraw the needle slightly and aim for the 9 o'clock position (1/2 EUOS group), 11 o'clock position (1/3 EUOS group) or 12 o'clock position (1/4 EUOS group) respectively. Cystometric evaluation and long-term studies was performed to evaluate the validity and reliability of the novel animal model. Another thirty-five mice was applied to investigate the histopathological features and protein expression.

Results: The characteristic features of cystometry in EUOS group shows increased pressure change related parameters compared with control. Especially the 1/3 EUOS can serves as an alternative pBOO animal model, which we find a striking resemblance between the 1/3 EUOS and the traditional open-surgery method in the cystometric evaluation and histopathological study.

Interpretation of results: The urodynamic characters in 1/3 EUOS group appears to be similar to the changes of PUO group. The 1/3 EUOS group has more in common with PUO group than just the pressure change related parameters, both of the two groups showed compensatory increase spontaneous activity displayed as NVCs during the bladder storage period (Figure 2). A relatively mildly increased amounts of collagen deposition and hypertrophy of muscles in the bladder musculature was found in the 1/3 EUOS group (Figure 3, A-E). Moreover, renal tubule lesions were found in the 1/2 EUOS and pBOO group. The two groups exhibited renal tubule with swollen epithelial cells, indicating impairment of renal function which is caused by bladder dysfunction. Initial urine cast in the tubule of 1/3 EUOS group. A similar fine structure of renal tubular cells were founded between the control and 1/4 EUOS group (Figure 3, F-J). The increased PCNA expression is associated with an increase degree of obstruction in EUOS (Figure 4).

Conclusions: The minimally invasive EUOS is takes less time and causes minimal alteration in pathophysiologically relevant process, compared with traditional surgery. Suture to cause EUOS has the potential to act as an alternative pBOO model.

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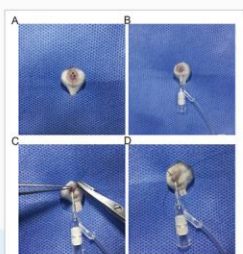


Fig 1

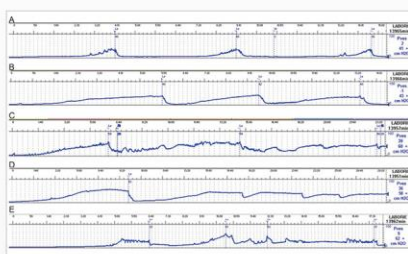


Fig 2

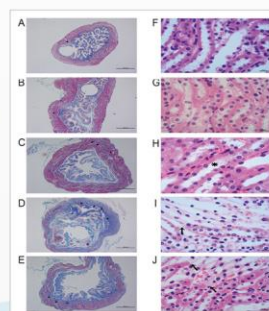


Fig 3

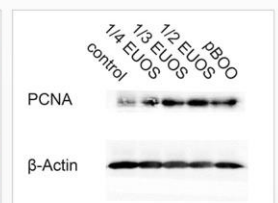


Fig 4