

An Improved Urethral Catheterization in Female Pigs: A Pilot Study

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With the popularity of urine flow dynamic monitoring and indwelling catheter technologies in animal experiments, the urethral catheterization has become a common technique in scientific research. The miniature pig is considered as one of the major animal species used in scientific research and is increasingly being used as an alternative to a dog or monkey as the nonrodent species of choice in the preclinical toxicological testing of pharmaceuticals.^[1] Since there are three acute angles bending in the urethra of the male miniature pig, and the end of the penis head is cork-screw shaped, it is difficult to implement routine urethral catheterization in male miniature pigs. Currently, researchers usually implement bladder colostomies or dissections in male miniature pigs, while transurethral urethral catheterization can be implemented in female miniature pigs. According to the existing reports, implementing transurethral urethral catheterization in female miniature pigs is seldom seen.^[2] We chose 3-month-old female Bama miniature pigs in our experiments and employ the following methods: first, use a “V”-shaped platform with an angle of about 30° to the horizontal plane; second, utilize a pediatric laryngoscope for deep lighting; third, bend the lower limbs and press down to the ventral side. Satisfactory results through transurethral urethral catheterization were achieved in the end.

Specific pathogen-free level Bama miniature pigs (female; $n = 10$; body weight = 7.0 ± 0.5 kg) were sourced commercially (Beijing Strong Century Minipigs Breeding Base) and cultured with a single cage, normal diet and drink in the Laboratory Animal Research Center of Capital Medical University. Before anesthesia, food was withheld for 12–24 h.

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University. This study followed the provisions of the Animal Experimental Ethics Committee (Both projects were approved by the Animal Experimental Ethics Committees at the Capital Medical University and in accordance with the Chinese code for the care and use of animals for scientific purposes [Ethical code: AEEI - 2015-159]).

The apparatus comprises one urethral catheterization plate, one piece of whole towel, one pair of sterile gloves, one sterile silicone catheter with double gasbag cavity (8Fr, Zhanjiang Star Enterprise Co., Ltd.), three curved pliers (20 cm), one set of pediatric laryngoscopes (E - MAC1 number: 93 mm × 11 mm, handle: rough handle, Beijing Belta Science & Technology Development Co., Ltd.), one syringe (20 ml), 5 ml aseptic paraffin oil (Suzhou Saipahan special oil limited company).

Ketamine (0.2 mg/kg, China National Pharmaceutical Group) and sumianxin (0.1 ml/kg, Dunhua Shengda Animal Pharmaceutical Co., Ltd) were given for general anesthesia. The miniature pigs were supine and fixed on the “V”-shaped platform with an angle of about 30° to the horizontal plane, and the lower limbs were bent and pressed down to the

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ventral side. The labial, vestibular, and urethral orifices should be sterilized with a 0.5% iodine-volt tampon to prevent infection. Wearing the gloves and laying a sterile whole towel on the operation field, an assistant clamps the edge of the vulva to the vaginal vestibule with two curlers and lifts it softly to open the catheter channel. The operator inserts a pediatric laryngoscope into the vaginal vestibule, pressing the rear with the left hand to light the surgery field to see the vaginal orifice clearly. The urethra is hidden in the vertical folds above the vaginal orifice [Figure 1]. Firstly, sterile paraffin oil was used to lubricate the catheter, which was then clipped by a vascular clamp at the front end, inserted into the urethra and extended about 5-6 cm before urine came out. After that, the catheter was pushed forward an additional 1 cm to complete the catheterization.

All female Bama miniature pigs ($n = 10$) were successfully implemented with transurethral catheterization; the average duration for transurethral catheterization was 15 min. Vulva and urethras were not damaged or bleeding during the urethral catheterization, and we could implement urine testing, urine flow dynamic monitoring, and dynamic observation of the urine weight, proportion, or color at any time according to our needs. No complications, such as infection, were observed after surgery, and we could choose the time for keeping the catheters after surgery as required.

The urethral catheterization of miniature pig has become a common technique in scientific research.^[3] Since there are three acute angles bending in the urethra of the male miniature pigs, and the end of the penis head is cork-screw shaped, it is difficult to implement routine urethral catheterization.^[4] The perineum structure of female miniature pig is special, but it is difficult to expose the urethra, so researchers usually abandon routine urethral catheterization as they cannot locate the urethra and further implement invasive bladder colostomy or centesis. However, these two methods can damage the continuity of the bladder and cannot simulate the clinical use of the urethral intubation effectively, which may influence the result of the experiment.^[5]

To solve this problem, we used 3-month-old female Bama miniature pigs to explore the effect of the method using a “V”-shaped platform with an angle of 30° to the horizontal plane, pediatric laryngoscope lighting, and the double lower limbs which were bent and pressed to the ventral side, and finally, we achieved satisfactory results through transurethral catheterization.

According to the experiments, we summarized the following experience. (1) As the urethra of a female miniature pig is located deep in the vaginal vestibule, we needed to enter the vaginal vestibule to see the vaginal orifice, which can be considered as an anatomical location marker, and the urethra is hidden in the vertical folds above the vaginal orifice, while the other longitudinal folds are all blind ends. (2) In our experiment, we used a pediatric laryngoscope instead of a cystoscope, ureteroscopy, or anorectal trilobal light retractor. The use of pediatric laryngoscope allowed us to see

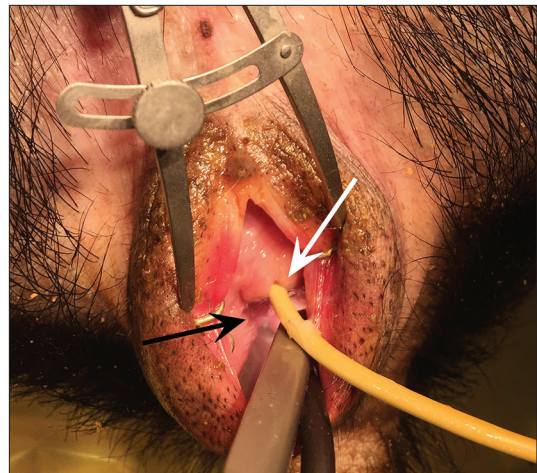


Figure 1: The urethra is hidden in the vertical folds above the vaginal orifice. White arrow refers to the urethral orifice fissure. i. The direction of the black arrow is shrinking round vaginal orifice.

the surgical field clearly and also improved the possibility of success. (3) During our experiment, the female Bama miniature pigs were fixed supine on a “V”-shaped platform with an angle of about 30° to the horizontal plane, and the lower limbs were bent and pressed down to the ventral side. This posture made the vulva fully exposed, which can shorten the relative operating distance of the vaginal vestibule, and eventually made the operation easier.

We have successfully completed the transurethral catheterization in female miniature pig through the following operation technology: “V”-shaped platform with an angle of about 30° to the horizontal plane, pediatric laryngoscope deep lighting, and bending lower limbs and pressing down to the ventral side. The method is noninvasive and repeatable, and it will be helpful to carry out experimental research on miniature pig in the future.

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Conflicts of interest

There are no conflicts of interest.

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