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A new experimental model for cryptorchidism: inguinoscrotal approach

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Abstract We investigated the effect of inguinal canal closure as a new mechanically induced cryptorchid rat model. The effectiveness of this new model was evaluated by histopathological examination. Thirty-one 21-day-old Wistar rats were divided into four groups. In groups 1 \((n = 6)\), 2 \((n = 6)\) and 3 \((n = 7)\), unilateral undescended testes was created by performing inguinal canal closure with inguinoscrotal approach. Sham-operated rats were used as controls in group 4 \((n = 12)\). The rats were killed on day 30 after surgery in group 1, day 45 in group 2 and day 60 in group 3. The seminiferous tubular diameter, number of tubules with mature germ cell and Leydig cell clusters were evaluated. None of the rats were lost during the study period. Signs of infection were not detected in operation site although antibiotics were not used. Overall only three \((16\%)\) testes descended into scrotum in study groups. The operation time was 3–4 min for each rat. Histopathological examination revealed detrimental effects of cryptorchidism on testicular growth in study groups. In all groups, except the sham group, the mean tubular diameter and the number of tubules with mature germ cells in the left testicle were significantly decreased compared to the right ones. Our findings were in correlation with other experimental studies using different rat models of cryptorchidism. This new model of cryptorchidism is considered to provide a simple and effective technique for investigating the impaired development of the testes in cryptorchidism.

Key words Experimental model · Cryptorchidism · Inguinoscrotal approach

Introduction

Many experimental models have been used to constitute a cryptorchidism model. Undescended testis was usually induced by endocrinological, natural or mechanical methods \([2, 3, 6, 7, 9, 10, 13, 14, 17–20]\). Antiandrogen \([2, 18]\), oestradiol \([7]\) or 5-α-reductase enzyme inhibitors \([3, 15]\) for endocrinological model, congenital cryptorchid mutant rat for natural model \([9]\) and intra-abdominal \([6, 10, 19, 20]\) or extra-abdominal approach \([13, 14]\) for mechanical model have been used to induce cryptorchidism. Of these models, the endocrinological model has partial success rate and probable side-effects on testis. The mechanical model has a risk for infection and mortality especially if abdominal approach is used. In addition, operation time may be longer and expensive material is used.

We investigated inguinal canal closure as a new experimental cryptorchid rat model. The effectiveness of this new model was evaluated by histopathological examination.

Materials and methods

Thirty-one 21-day-old Wistar rats were divided into four groups. At day 21, the rats in all groups were weaned from their mothers and raised in a light-controlled (12 h light/12 h dark) environment, with free access to food and water. Anaesthesia was achieved with intraperitoneal injection of ketamine hydrochloride (Ketalar, 10 mg/kg) and xylazine hydrochloride (Rompun, 2 mg/kg). In groups 1 \((n = 6)\), 2 \((n = 6)\) and 3 \((n = 7)\), unilateral undescended testis was created by performing inguinal canal closure with inguinoscrotal approach. When they reached days 30, 45 and 60 after operation, the animals were sacrificed and the location of the testes was confirmed by manual examination. Sham-operated rats were used as controls in group 4 \((n = 12)\). The experimental procedures were approved by the local animal ethics committee.

Surgical technique

After anesthesia, the scrotal region was shaved and cleaned by povidon iodine. Inguinoscrotal region was incised and the guber-
naculum was separated where it protruded from the abdominal wall, and then the external inguinal ring was revealed. After pushing the gubernaculum into the abdominal cavity, the external inguinal ring was closed by 6/0 nonabsorbable suture material (Prolene; Ethicon, UK). Inguinoscrotal wall was sutured by 5/0 absorbable suture (Vicryl; Ethicon, UK; Figs. 1–4).

**Fig. 1** Incision line on inguinoscrotal region

**Fig. 2** Gubernaculum was separated where it protruded from the abdominal wall

**Fig. 3** Appearance of inguinal canal

**Fig. 4** Closure of inguinal canal