

Short Communication

Anti-Müllerian hormone: a potential biomarker for differential diagnosis of cryptorchidism in dogs

F. Gharagozlou, R. Youssefi, V. Akbarinejad, N. I. Mohammadkhani, T. Shahpoorzadeh

CRYPTORCHIDISM, in which the testes fail to descend into the scrotum by six months of age, is a developmental disorder in male dogs (Johnston and others 2001). Cryptorchidism predisposes the animal to testicular neoplasia, therefore the retained testes should be surgically removed for the health of the animal (Johnston and others 2001). Hence, when deciding whether to perform surgery, it is diagnostically essential that cryptorchidism be differentiated from other conditions in which the testes are not present in the scrotum, including anorchidism or cases that have been castrated (England and others 1989; Johnston and others 2001).

Anti-Müllerian hormone (AMH) is produced by Sertoli cells in different species of mammals, including dogs, and plays a crucial role in sexual differentiation; that is, AMH induces the regression of the paramesonephric ducts during the early embryonic development in male foetuses (Banco and others 2012). AMH has been used to differentiate cryptorchidism from anorchidism in humans (Lee and others 1997). In addition, AMH has been reported to be higher in cryptorchid stallions than in intact and castrated ones (Claes and others 2013).

Therefore, the present study was conducted to evaluate AMH concentration in cryptorchid dogs compared with intact and castrated ones.

The Animal Care Committee of the Faculty of Veterinary Medicine, University of Tehran approved the present study in terms of ethics. The dogs enrolled in the study were over six months of age and mostly of toy breeds. The owners signed the informed consent form prior to enrolment of the animal in the study.

Blood samples were collected via the cephalic vein of bilateral cryptorchid (n=10), intact (n=7) and castrated (n=7) dogs. Human MIS/AMH Gen II ELISA kit (Beckman Coulter, Brea, CA, USA) was used to measure serum AMH concentration. To validate canine serum AMH assay, parallelism of dilutions of sera from cryptorchid (n=1) and intact (n=1) dogs with AMH standard curve was assessed prior to using the kit for the evaluation of AMH concentrations in dogs.

Dilution curves of cryptorchid (n=1) and intact dogs were parallel with the AMH standard curve (Fig 1).

Initially, datasets were tested for normal distribution using Kolmogorov–Smirnov test (UNIVARIATE procedure). Given that the assumptions of parametric tests were not achieved, Kruskal–Wallis one-way analysis of variance (ANOVA) was used to analyse the data. All analyses were conducted in SAS (Statistical Analysis System software, SAS/STAT V.9.2, SAS Institute, Cary, NC, USA). Data are presented as medians.

AMH concentrations in intact (median: 1.27 ng/ml; range: 0.69–2.53 ng/ml) and cryptorchid (median: 1.61 ng/ml; range: 0.85–5.96 ng/ml) dogs were higher than those in castrated dogs (median: 0.08 ng/ml; range: 0.03–0.12 ng/ml; $P<0.01$; Fig 2). However, AMH concentrations did not differ between intact and cryptorchid dogs ($P>0.05$).

The present study revealed that AMH could serve as an indicator for the presence of testicular tissue regardless of whether the testes have descended into the scrotum or not. A higher concentration of AMH in intact dogs than in castrated dogs has been reported previously (Ano and others 2014). Likewise, evaluating AMH concentrations in castrated, intact and cryptorchid stallions, Claes and others (2013) found significantly higher concentrations of AMH in intact and cryptorchid stallions than in castrated stallions. Moreover, measurement of serum AMH concentration has been indicated as a reliable method to determine the presence of testicular tissue in humans (Lee and others 1997). Therefore, AMH could serve as a biomarker for differential diagnosis of cryptorchidism from cases with non-palpable testes due to anorchidism or castration.

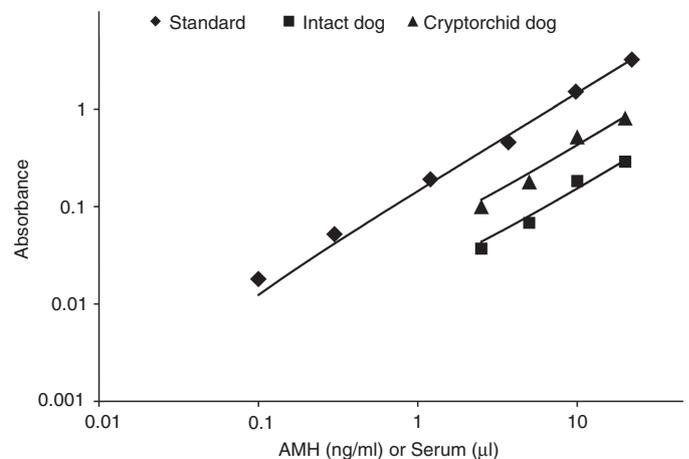


FIG 1: Parallelism of sera from intact and cryptorchid dogs with anti-Müllerian hormone standard curve.

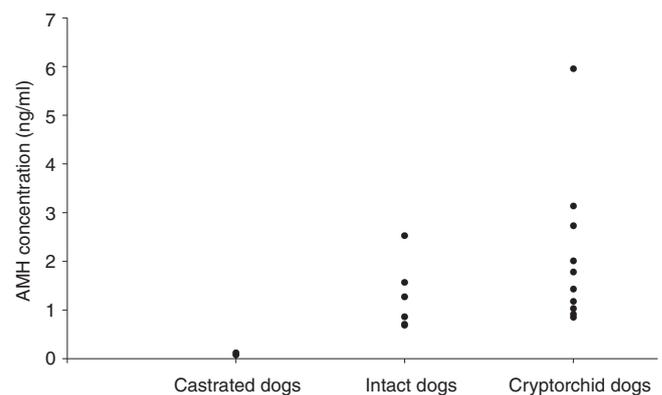


FIG 2: Dot plot of anti-Müllerian hormone (AMH) concentrations in castrated, intact and cryptorchid dogs.

Veterinary Record (2014)

doi: 10.1136/vr.102611

F. Gharagozlou, DVM, DVSc,
R. Youssefi, DVM,
N. I. Mohammadkhani, BSc,
T. Shahpoorzadeh, DVM,
Department of Theriogenology, Faculty
of Veterinary Medicine, University of
Tehran, Tehran, Iran
R. Youssefi, DVM,
Theriogenology Association, Faculty
of Veterinary Medicine, University of
Tehran, Tehran, Iran

V. Akbarinejad, DVM,
Young Researchers and Elites Club,
North Tehran Branch, Islamic Azad
University, Tehran, Iran

E-mail for correspondence:
v_akbarinejad@ut.ac.ir

Provenance: Not commissioned;
externally peer reviewed.

Accepted July 23, 2014

Short Communication

Although the concentration of AMH in cryptorchid dogs was numerically higher than that in intact dogs, the difference was not statistically significant. [Ano and others \(2014\)](#) observed a considerably higher concentration of AMH in a cryptorchid dog with Sertoli cell tumour than in intact dogs. [Claes and others \(2013\)](#) reported higher concentrations of AMH in cryptorchid stallions than in intact stallions. Nevertheless, the effect of cryptorchidism on testicular secretion of AMH in dogs remains to be elucidated in further studies with more cases and controls.

References

- ANO, H., HIDAKA, Y. & KATAMOTO, H. (2014) Evaluation of anti-Müllerian hormone in a dog with a Sertoli cell tumour. *Veterinary Dermatology* **25**, 142–5, e41
- BANCO, B., VERONESI, M. C., GIUDICE, C., ROTA, A. & GRIECO, V. (2012) Immunohistochemical evaluation of the expression of anti-Müllerian hormone in mature, immature and neoplastic canine Sertoli cells. *Journal of Comparative Pathology* **146**, 18–23
- CLAES, A., BALL, B. A., ALMEIDA, J., CORBIN, C. J. & CONLEY, A. J. (2013) Serum anti-Müllerian hormone concentrations in stallions: developmental changes, seasonal variation, and differences between intact stallions, cryptorchid stallions, and geldings. *Theriogenology* **79**, 1229–1235
- ENGLAND, G. C. W., ALLEN W. E. & PORTER, D. J. (1989) Evaluation of the testosterone response to hCG and the identification of a presumed anorchid dog. *Journal of Small Animal Practice* **30**, 441–443
- JOHNSTON, S. D., ROOT KUSTRITZ, M. V. & OLSON, P. S. (2001) *Canine and Feline Theriogenology*. Philadelphia, USA: WB Saunders.
- LEE, M. M., DONAHOE, P. K., SILVERMAN, B. L., HASEGAWA, T., HASEGAWA, Y., GUSTAFSON, M. L., CHANG, Y. & MACLAUGHLIN, D. T. (1997) Measurements of serum Müllerian inhibiting substance in the evaluation of children with nonpalpable gonads. *New England Journal of Medicine* **336**, 1480–1486



CrossMark

Anti-Müllerian hormone: a potential biomarker for differential diagnosis of cryptorchidism in dogs

F. Gharagozlou, R. Youssefi, V. Akbarinejad, N. I. Mohammadkhani and T. Shahpoorzadeh

Veterinary Record published online August 25, 2014

Updated information and services can be found at:
<http://veterinaryrecord.bmj.com/content/early/2014/09/01/vr.102611>

These include:

References

This article cites 5 articles, 0 of which you can access for free at:
<http://veterinaryrecord.bmj.com/content/early/2014/09/01/vr.102611#BIBL>

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>