

Testosterone concentration in a bovine *Bos indicus* with bilateral varicocele. Case report

Concentração de testosterona em um bovino *Bos Indicus* com varicocele bilateral. Relato de caso

Marion Burkhardt KOIVISTO¹; Maria Cristina Rui LUVIZOTTO¹;
Guilherme Padua NOGUEIRA²; Wilter Ricardo Russiano VICENTE³;
Marcelo Tadeu Alvarenga COSTA⁴

CORRESPONDÊNCIA PARA:
MARION BURKHARDT DE KOIVISTO
Curso de Medicina Veterinária
Faculdade de Odontologia
UNESP - Campus de Araçatuba
Rua Clóvis Pestana 793
Caixa Postal 341
16050-680 Araçatuba - SP
e-mail: koivisto@fmva.unesp.br

1- Departamento de Clínica, Cirurgia e
Reprodução Animal da Faculdade de
Odontologia da UNESP, Araçatuba - SP
2- Departamento de Apoio, Produção e
Saúde Animal da Faculdade de Odontologia
da UNESP, Araçatuba - SP
3- Departamento de Medicina Preventiva e
Reprodução Animal da Faculdade de
Ciências Agrárias e Veterinárias da UNESP,
Jaboticabal - SP
4 - Central VR, Araçatuba - SP

SUMMARY

A bovine, *Bos indicus*, with bilateral varicocele diagnosed by palpation and ultrasound observation was observed during 24 months measuring scrotal circumference, semen quality, testosterone concentrations comparing with seasonal variation and other animals of the same species. The abnormal morphology of major defects and minor defects didn't change between the bull and the other animals, however, the total defects were higher during the summer in the bull with varicocele ($49,9\% \pm 6,9$) when compared with the other bulls ($27,9\% \pm 2,9$). The animal showed higher percentage of major defects during the summer, comparing with the other seasons of the year. For the animal with varicocele testosterone levels were significantly higher during the different season's of the year, whereas decreasing levels in the summer were seen in all *Bos indicus*. The clinical diagnostic was confirmed by necropsy. This pathology, characterized by a bilateral varicocele with thrombosis of the spermatic cord vessels, showed that the thermoregulation suffered establishing severe testicular degeneration. As seric testosterone increased suggesting lack of steroid retention at the testicle by the pampiniform plexus, the sperm production was abnormal.

KEY-WORDS: Varicocele. Bovine. Semen. Testosterone. *Bos indicus*.

INTRODUCTION

Varicocele is a dilation and tortuosity of the veins of the pampiniform plexus and the cremasteric veins⁹. Jensen⁸ defined it to be a local disturbance characterized by sacular dilatation and thrombosis in the internal spermatic vein. It is observed occasionally in stallions, rarely in the bull, and in about 1-2% of rams, in which occurrence increases with age. In Brazil, Fêo et al.⁶ reported a case of varicocele in bovine.

The etiology of varicocele is unknown, but in humans deficiency of valves in veins draining the testis is considered likely. Deficiency of elastic and fibrous tissue in surrounding fascia is another possibility. Varicoceles appear as dark red nodules, 1-3 cm or more in diameter, enclosed in fascia of the spermatic cord proximal to the testis. Dissection of varicoceles may reveal large organizing laminated thrombi⁹.

All varicoceles are thrombosed; changes associated with larger varicoceles include testicular mineralization suggesting a deficiency of thermoregulatory mechanism of the testis^{5, 9, 12}.

In adolescent varicocele in humans, testicular degeneration is evidenced by premature germ cells sloughing, decreased number of large-state forms of germ

cells (secondary spermatocytes, spermatids, and spermatozoa) and some degree of tubular sclerosis⁹.

Detailed histologic studies have revealed an apparently independent sclerosis involving almost 50% of both arteries and veins in the spermatic cords of rams. The arterial changes, which tend to be bilateral, consist of fibroplasia of the tunica intima. A variable degree of intimal and or medial mineralization may also be seen in branches of the testicular artery in the spermatic cords of rams and bucks.

A review of literature showed few data referring to varicocele in bovine. The present study was carried out in order to observe seminal characteristics, hormonal findings of testosterone levels (nmol/L) in the systemic blood, and an anatomy-pathological study of the spermatic cords and testes in a *Bos indicus* bull with bilateral varicocele.

MATERIAL AND METHOD

A *Bos indicus* bull of nearly 13 years showed evident modifications of the spermatic cords detected by physical examination. The bull was located at an AI Centre in the northeast part of Brazil. The ambient temperature ranged from average +18°C (winter) to 33°C (summer). The bull was maintained on native pasture (*Cynodon plectostachyus*) with

supplementation. Semen was collected in an artificial vagina twice a week in intervals of three days during two years completing 184 collections. Immediately following collection, the semen was evaluated according to standard procedures for volume, mass-activity, motility, concentration and morphology.

Monthly scrotal circumference was measured with a scrotal tape and blood samples were taken in the jugular vein. The blood was centrifuged immediately and the plasma harvested and stored at -20°C . Plasma concentrations of testosterone were determined by solid-phase I^{125} radioimmunoassay (Coat-A-Count Diagnostic Products Cooperation, USA). All samples were processed in duplicate.

During the experiment ultrasound images (Scanner 480 Vet – Pie Medical) with a linear transducer were performed. The frequency used was 5,0MHz. Changes were observed at the spermatic cords of both testes. Following culling the reproductive tracts were examined macroscopically. Pieces of testis, epididymides and

spermatic cords were fixed in Bouin's fluid for histopathological studies. The pieces were embedded in paraffin wax and sections cut at 5 microns were stained with hematoxylin and eosin¹¹.

Other nine bulls *Bos indicus* also were evaluated in order to compare with the animal which showed the pathological change.

For statistical analysis the nonparametric Friedman test were performed comparing the variation of abnormal spermatozoa during the different seasons of the year. The Mann-Whitney test was used in order to compare the average value of the bulls with the other *Bos indicus*. The values are expressed in average \pm SD.

RESULTS

The physical examination of the animal revealed a nodular enlargement of the spermatic cords. The scrotum had a marked clinical enlargement and pendulous

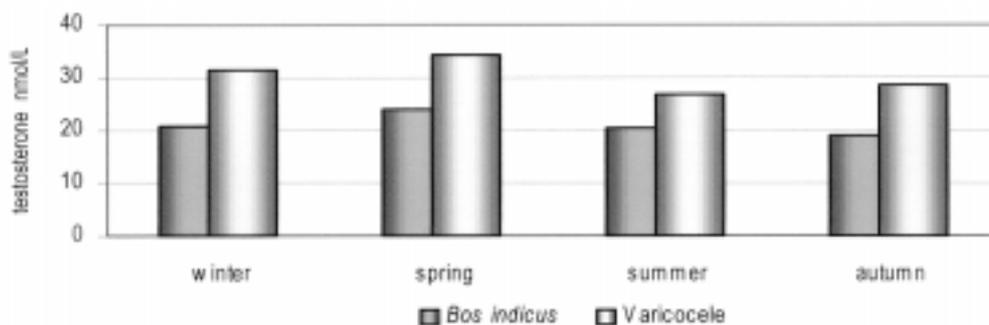


Figure 1. Monthly variation in testosterone concentration (nmol/L) between the bull with varicocele and other's *Bos indicus* during a 2 years period. Araçatuba, 2000.

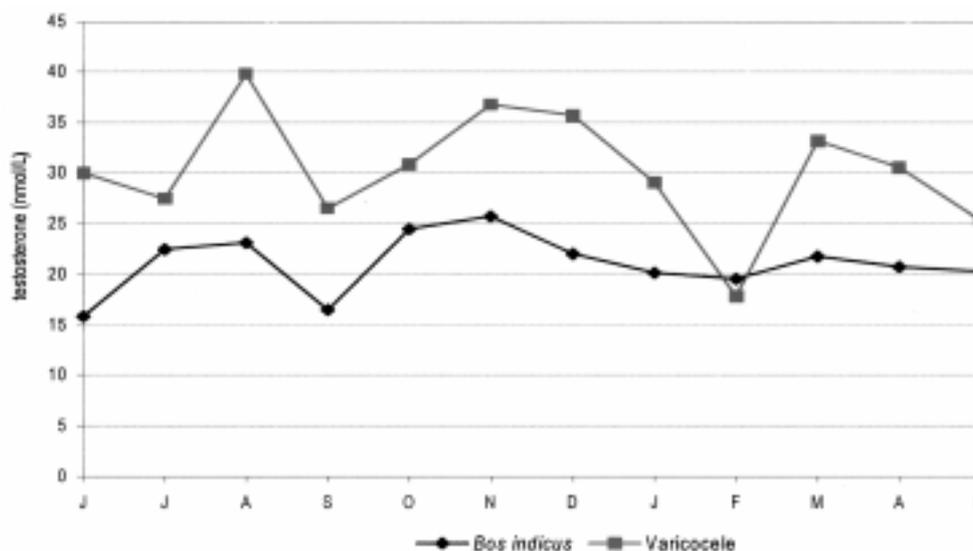


Figure 2. Seasonal variation of testosterone concentration (nmol/L) comparing the animal with varicocele and other 9 *Bos indicus* during a 2 years period. Autumn (april, may, june), winter (july, august, september), spring (october, november, december) and summer (january, february and march). Araçatuba, 2000.

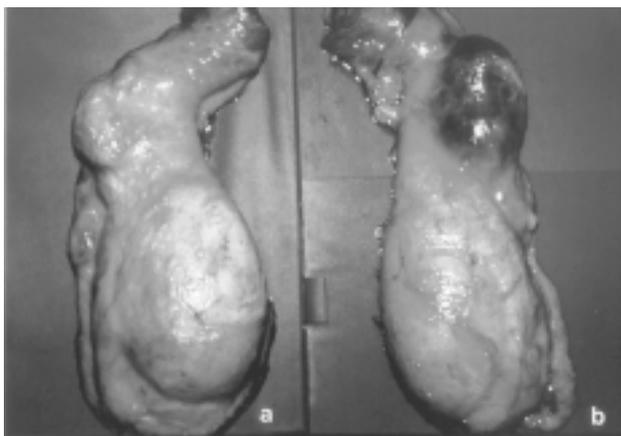


Figure 3

Spermatic cord with firm nodules at palpation (a= right testicle; b= left testicle). Araçatuba, 2000.



Figure 4

Varicocele with vascular thrombosis (left testicle). Araçatuba, 2000.

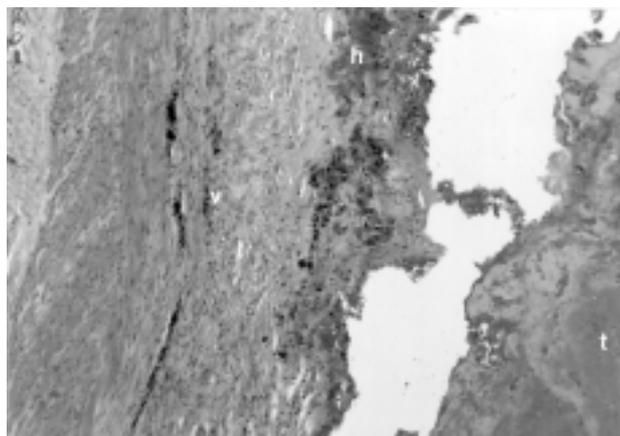


Figure 5

Microscopic aspects of vascular thrombosis. t (thrombosis), v (vessel), h (hemosiderin). HE. Obj. 40x. Araçatuba, 2000.x

conformation and, on palpation, painful sensibility of the testes. The presence of a right scrotal frenulum results in moderate lateral rotation of 90° of the testes.

During the period of observation, the average of scrotal circumference was $46,4 \pm 1,1$ cm and the seminal values were: volume $3,8 \pm 2,8$ ml, motility $59,3 \pm 5,7$ %, mass-activity $3,6 \pm 0,8$, concentration $1660,6 \pm 353,7$ spermatozoa/mm³.

Considering the seasonal changes there were significant difference ($p < 0,005$) of major defects and total defects in the summer comparing with the other seasons (Tab. 1). During the two year period the bull showed average values of major and total defects ($25,4 \pm 16,1$ %; $11,1 \pm 8,2$ % and $35,3 \pm 3,1$ %; $23,0 \pm 1,5$ %, respectively), higher than other bulls of the same species. The average percentage of minor defects in the bull didn't show significant difference comparing with the other animals ($9,9 \pm 2,9$ %; $12,2 \pm 7,6$ %, respectively).

Referring to the plasma concentrations of testosterone, the monthly mean values were higher in the bull with varicocele when compared with the other *Bos indicus* bulls (Fig. 1).

Figure 2 shows a seasonal analysis of the plasma concentration of testosterone found in the bull with varicocele and the bulls *Bos indicus*.

Palpating the spermatic cords two nodules of firm

Table 1

Seasonal variation of abnormal spermatozoa morphology determined during 24 months in a bull with varicocele compared with the seasonal average morphological abnormalities of spermatozoa in nine bulls of the same breed. Araçatuba, 2000.

Season	Varicocele		<i>Bos indicus</i>	
	Major Defects	Total Defects	Major Defects	Total Defects
Spring	$14,7^b \pm 2,4$	$14,9^b \pm 3,3$	$21,3 \pm 0,8$	$11,9 \pm 1,6$
Summer	$39,9^a \pm 7,8$	$49,9^{aA} \pm 6,9$	$23,5 \pm 5,3$	$27,9^B \pm 2,9$
Autumn	$16,3^b \pm 3,5$	$36,6^b \pm 5,7$	$25,7 \pm 6,9$	$24,0 \pm 2,2$
Winter	$20,2^b \pm 4,1$	$18,0^b \pm 3,6$	$11,9 \pm 1,5$	$25,5 \pm 2,4$

Different minuscule letters denote difference between the seasons

Different capital letters denote difference between the animals

consistency were evident at the left, one of them measuring about 4,0 cm of diameter proximal to the testes and the other with 1,5 cm more distant. At the right spermatic cord there was a nodule of 2,0 cm with the same characteristics described before (Fig. 3 and 4). The testicular consistency or tone was decreased losing the normal resilience.

Through ultrasound examination at the left testicular parenchyma it was possible to detect small focal disseminated hyperechoic areas. At the spermatic cords the areas corresponding to the nodules showed compact hypoechoic image of low density.

The macroscopic evaluation of the spermatic cords revealed dilatation of the veins and arteries and large organizing laminated thrombi, with focus of calcification at the center. The testes with altered consistency, showed in the middle several hardened points, suggesting mineralization.

Microscopic examination revealed sclerosis and fibroplasia of the tunica intima and media of the testicular arteries in the spermatic cords occurring pigment deposition of hemosiderin close to the mural thrombosis (Fig. 5).

DISCUSSION

Scrotal circumference was higher in the bull with varicocele comparing with the other animals of the same group (42,6 to 41,0 cm) indicating a patologic condition confirmed through palpation, ultrasound and through histologic features. Through microscopic examination the testes showed moderate to severe degeneration evidenced by partial or total lack of spermatogenesis, as well as multinuclear cells in the lumen of the seminiferous tubules that were calcified similar to the description of Desphande et al.⁴, Ezzi et al.⁵; Machado et al.¹² and Jubb et al.⁹.

During 24 month's seminal values like volume, motility, mass activity and concentration were not affected by the bilateral varicocele. So the average values for seminal characteristics were similar for the Zebu breed⁷.

The average values of morphologic abnormalities were higher than in the other bulls of the same species. The

percentage of spermatozoa with abnormal morphology considering the major defects $25,4 \pm 16,0$ % and total defects $35,3 \pm 15,2$ %, showed a higher incidence than the standard values for the species. The average of minor defects $9,9 \pm 2,9$ % were within reference values^{2,3,7}.

Considering the seasonal changes there were significant difference ($p < 0,005$) of major defects and total defects in the summer comparing with the other seasons. These results are in agreement with the observations of Koivisto et al.¹⁰. The prevailing major defect was the proximal droplet and according to Ott¹⁵ and Barth and Oko¹ would reveal a defect at the level of the seminiferous tubules confirmed through the findings of testicular degeneration by histological studies.

Considering the plasma concentrations of testosterone, the monthly mean values were higher in the bull with varicocele when compared with the other *Bos indicus* bulls (Fig. 1), suggesting that the secretion rate of this steroid was modified due to the present pathology¹⁴.

Observations done by Rhynes and Ewing¹⁷, Malgrem¹²; Prabhkar et al.¹⁶ and Sidibé et al.¹⁸ who described a decrease in plasma concentration of testosterone after high environmental temperature are in agreement with the present work where a seasonal analysis of the plasma concentration of testosterone (Fig. 2) in the bull with varicocele and the bulls *Bos indicus* showed a significant difference for all the season's less summer, where the testosterone levels were lower for all animals¹³.

CONCLUSION

According to the histological findings, seminal evaluation and hormonal quantification, this case refers to a severe testicular degeneration caused by bilateral varicocele followed by an increase of proximal droplets and increase in the plasma concentration of testosterone.

ACKNOWLEDGEMENT

The authors gratefully acknowledge Laine Margareth Gabas for her assistance. This work was supported in part by FUNDUNESP.

RESUMO

Um reprodutor bovino, *Bos indicus*, com varicocele bilateral detectado por palpação e ultra-sonografia foi acompanhado por um período de 24 meses quanto à biometria testicular, valores espermáticos e concentração de testosterona comparados entre as estações do ano e outros animais da mesma espécie. As alterações morfológicas dos defeitos maiores e menores não variaram entre o touro com a patologia e os demais touros, no entanto, durante o verão o touro com varicocele apresentou maior percentual de defeitos totais se comparado aos demais touros da mesma espécie ($49,86\% \pm 6,9$ e $27,91\% \pm 2,9$). O animal apresentou maior percentual de defeitos maiores no verão se comparado às outras estações do ano. Os achados de necropsia confirmaram o diagnóstico clínico. Pode-se concluir que esta patologia, caracterizada por trombose nos vasos do cordão espermático, comprometeu a termoregulação determinando degeneração testicular severa. O aumento das concentrações de testosterona sérica sugerem a diminuição da retenção de esteroides nos testículos pelo plexo pampiniforme, a produção espermática estava anormal.

UNITERMOS: Varicocele. Bovino. Sêmen. Testosterona. *Bos Indicus*.

KOIVISTO, M.B. , LUVIZOTTO, M.C.R., NOGUEIRA, G.P., VICENTE, W.R.R., COSTA, M.T.A. Testosterone concentration in a bovine *Bos indicus* with bilateral varicocele. Case report. **Braz. J. vet. Res. anim. Sci.**, São Paulo, v.39, n.1, p. 27-31, 2002.

REFERENCES

1. BARTH, A. D.; OKO, R. J. **Abnormal morphology of bovine spermatozoa**. 1. ed. Iowa State: University Press, 1989. p. 285
2. BLOM, E. The ultrastructure of some characteristic sperm defects and a proposal for a new classification of the bull spermogram. **Nord. Vet. Med.**, v.25, n.7, p.383-391, 1973.
3. COLÉGIO BRASILEIRO DE REPRODUÇÃO ANIMAL. **Manual para exame andrológico e avaliação de sêmen animal**. Belo Horizonte: Colégio Brasileiro de Reprodução Animal, 1998. p. 49.
4. DESHPANDE, K. S.; DIWAN, J. G.; WAKANKAR, C. C.; DESHPANDE, B. R. Varicocele in a Merino ram. **Indian Veterinary Journal**, v. 56, n. 3, p. 236-239, 1979.
5. EZZI, A.; LADDS, P. W.; HOFFMANN, D.; FOSTER, R. A.; BRIGGS, G. D. Pathology of varicocele in the ram. **Australian Veterinary Journal**, v. 65, n. 1, p. 11-15, 1988.
6. FÊO, J. C. S. A.; BERNABE, C. R.; VISINTIN, J. A.; GUERRA, J. A case of varicocele in a bull. In: INTERNATIONAL CONGRESS ON ANIMAL REPRODUCTION AND ARTIFICIAL INSEMINATION, 9. 1980, Madrid, Espanha. **Anais...** Madrid, 1980. v. 3, p. 252.
7. FONSECA, V. O. et al. **Procedimentos para avaliação andrológica e do sêmen congelado**. Belo Horizonte: Colégio Brasileiro de Reprodução Animal, 1992, p. 79.
8. JENSEN, R. **Diseases of sheep**. Philadelphia: Lea and Febinger, 1974. p. 6-8.
9. JUBB, K. V. F.; KENNEDY, P. C.; PALMER, N. **Pathology of domestic animals**. 4. ed., San Diego: Academic Press, 1992, vol. 3, p. 633.
10. KOIVISTO, M. B.; NOGUEIRA, G. P.; COSTA, M. T. A. *Bos taurus taurus* x *Bos taurus indicus*. Fluctuations of the sperm abnormalities (previous note). In: CONGRESSO PANAMERICANO DE CIÊNCIAS VETERINÁRIAS, 15., 1996, Campo Grande, MS, Brasil. **Anais...** Campo Grande, 1996. p. 385.
11. LUNA, L. G. **Manual of histologic staining methods of the armed forced institute of pathology**. 3. ed. New York: Mac-Graw-Hill, 1968. p. 258.
12. MACHADO, R.; SIMPLÍCIO, A. A.; SANTA ROSA, J. Varicocele bilateral em ovino Ile de France (bilateral varicocele in Ile de France). In: CONGRESSO BRASILEIRO DE REPRODUÇÃO ANIMAL, 9., 1996, Belo Horizonte, MG, Brasil. **Anais...** Belo Horizonte: Colégio Brasileiro de Reprodução Animal, 1991. p.407
13. MALMGREM, L. Experimental induced testicular alterations in boars: Hormonal changes in mature and peripubertal boars. **Acta Vet. Scand.**, v. 31, n. 1, p. 97-107, 1990.
14. McDONALD, L. E.; PINEDA, M. H. **Veterinary endocrinology and reproduction**. 4. ed., Philadelphia: Lea & Febinger, 1989. p. 571.
15. OTT, R. S. Breeding soundness examination of bulls. In: MORROW, D. A. **Current therapy in theriogenology**. London: W.B. Saunders, 1986. p. 1143.
16. PRABHAKAR, J.; CHIMBONI, M.; MALMGREN, L.; FREDRIKSSON, G.; MADJEY, A. Effects on Testosterone and LH Concentrations of induced Testicular Degeneration in Bulls. **Acta Vet. Scand.**, v. 31, n. 4, p. 505-507, 1990.
17. RHYNES, W. E.; EWING, L. L. Testicular endocrine function in Hereford bulls exposed to high ambient temperature. **Endocr.**, v. 92, n.2, p. 509-515, 1973.
18. SIDIBÉ, M.; FRANCO, L. A.; FREDERIKSSON, G.; MADEJ, A.; MALGREN, L. Effects on Testosterone, LH and Cortisol Concentrations, and on Testicular Ultrasonographic Appaerance of Induced Testicular Degeneration in Bulls. **Acta Vet. Scand.**, v. 33, n. 3, p.191-196, 1992.

Received: 26/03/2001

Accepted: 27/02/2002