Publicación cuatrimestral del Hospital Universitario "General Calixto García" | Editorial de Ciencias Médicas

Archivos del Hospital Universitario "General Calixto García"

AÑO 2023
VOL. XI NO. 2
ISSN 2707-9120

Research article

Prevalence of genital abnormalities in young soccer players from Guinea Bissau

Prevalencia de anomalías genitales en futbolistas jóvenes de Guinea Bissau

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Cómo citar este artículo

Castillo T, Casado Méndez P, Santos Fonseca R, Monteiro A, Fonseca Sosa F, del Castillo Remón I. Prevalencia de anomalías genitales en futbolistas jóvenes de Guinea Bissau. Arch Hosp Univ “Gen Calixto García”. 2023;11(2):366-75. Acceso: 00/mes/2023. Disponible en: https://revcalixto.sld.cu/index.php/ahcg/article/view/1140

ABSTRACT

Introduction: Genital examination in young athletes pursues the identification of genital abnormalities or diseases as well as the establishment of pubertal development.
Objective: To determine the prevalence of genital abnormalities and the value of the use of genital examination in young soccer players from Guinea Bissau.
Methods: A quantitative, cross-sectional, observational and descriptive study was carried out on a universe of 94 young soccer players in the Bafata and Gabu regions, Guinea Bissau, from January to April 2023. Variables such as age, presence of genital abnormalities, type of genital abnormality, and Tanner's stage of genital development were measured.
Results: A 24.47 % prevalence of genital abnormalities was identified; there was a high prevalence of varicocele (13.83 %), followed by phimosis (4.26 %), short frenulum (2.13 %), hydrocele (2.13 %), hypospadias (1.06 %) and monorchia (1.06 %). Pubertal development was normal in all youngsters.
Conclusions: Routine genital examination in young athletes is essential as a preventive health strategy to certify physical conditions for sports practice.
Keywords: Genital abnormalities; youngsters; genital exam.

RESUMEN

Introducción: El examen genital en deportistas jóvenes persigue la identificación de anormalidades o enfermedades genitales y establecer el desarrollo puberal.
Objetivo: Determinar la prevalencia de anormalidades genitales y el valor de uso del examen genital en futbolistas jóvenes en Guinea Bissau.
Método: Se realizó un estudio cuantitativo, transversal, observacional y descriptivo en un universo de 94 jóvenes futbolistas en las regiones de Bafata y Gabu, Guinea Bissau en el período comprendido entre enero - abril 2023. Se midieron las variables edad, presencia de anormalidades genitales, tipo de anormalidad genital y estadio del desarrollo genital de Tanner.
Resultados: Se identificó un 24,47 % de prevalencia de anormalidades genitales con amplia prevalencia del varicocele (13,83 %) seguida del padecimiento de fimosis (4,26 %), frenillo corto (2,13 %), hidrocele (2,13 %), hipospadia (1,06 %) y monorquia (1,06 %). El desarrollo puberal fue normal en la totalidad de los jóvenes.
Conclusiones: El examen genital rutinario en jóvenes atletas es imprescindible y constituye una estrategia más de salud preventiva en la certificación de condiciones físicas para la práctica deportiva.
Palabras clave: Anormalidades genitales; jóvenes; examen genital.

ISSN 2707-9120

INTRODUCTION

Morphological alterations in both male and female reproductive organs are recognized as genital abnormalities (GA). Abnormalities of external genitals are present in about 1:400 babies.[1,2] Disorders of the male sexual development (DSD) represent the most challenging clinical conditions, which include a wide spectrum of abnormalities that range from a complete female phenotype to the mildest androgenization defects.[3,4,5]

Male genital differentiation begins with the sex-determining region of the Y chromosome (SRY-gene) by encoding the bipotent gonad that will determine a male phenotype. The SRY-gene helps to foster Sertoli cells differentiation that produces Müllerian inhibiting substance (MIS), also known as anti-Müllerian hormone (AMH), which prevents the development of the female pattern. The pathophysiology of milder defects such as isolated cryptorchidism, hypospadias, anorchia, and congenital penile curvature is even less well understood, although a combination of underlying genetic and environmental factors has been advocated.[6,7]

The diagnosis of genital abnormalities starts in the prenatal stage and continues in newborns, children, and adolescents. Despite the great advances in ultrasound in almost all the fields of the prenatal diagnosis, its development and impact on the early diagnosis of genital abnormalities are really poor.[3,5,8]

Doctors must be able to recognize common disorders of male external genitalia and differentiate urgent conditions from the most benign ones. The recognition, diagnosis, management and treatment of genital abnormalities will depend on the type of malformation, which is often complex and requires the involvement of multiple specialties such as pediatrics, endocrinology or urology.[1,4]

Genital examination is part of the regular medical control and school physical education, which in turn, constitute fundamental tools that influence on the rights of children and adolescents. This examination evaluates the state of health as an early marker of maturation and growth rate. In the case of children and adolescent athletes, training load planning is determined by findings on the physical exam. The low incidence of genital abnormalities along with their little or no impact on sports performance very rarely determine the restriction of sports practice.[9,10]

In the face of reducing morbidity due to genital abnormalities in adolescent soccer players, as well as reducing the quality of life related to health and sports performance together with the work of the medical staff and the importance of the genital examination, a study aimed at determining the prevalence of genital abnormalities and the value of genital examination was conducted on young soccer players from Guinea Bissau.

METHODS

ISSN 2707-9120

A quantitative, cross-sectional, observational and descriptive study was performed on a universe of 94 young soccer players from soccer clubs in Bafata and Gabu regions, Guinea Bissau in January-April 2023. The inclusion criteria included: to be between 7 and 19 years old, as well as to be member of the soccer club for at least 1 year. Data collection sheets, which compiled data from the study constructs (age, presence of genital abnormalities, type of genital abnormalities, and Tanner's stage of genital development), were filled out for each patient admitted in the study. This form was also completed by the authors of this research work.

Each patient underwent a genital examination in anatomical standing position. The examination was carried out under systematic observation and palpation of the testicles and the spermatic cord, before and after the Valsalva maneuver. A total examination of the penis was carried out, and every patient underwent testicular ecography for the diagnosis of varicocele. Pubertal development in boys was evaluated according to Tanner's stages.

Descriptive statistics and trend dispersion measures were used for data analysis of quantitative variables; in contrast, frequency distributions were used for qualitative ones. Moreover, 95 % confidence interval was used.

The study was approved by the Research Ethics Committee of the Bafata and Gabu Regional Hospitals, with authorizations signed by the trainers. Confidentiality of the information was guaranteed as a requirement of the ethical principles assumed in this research, based on the Declaration of Helsinki (Seoul, Korea, October 2008) and in conjunction with the update made in Fortaleza, Brazil, in 2013.

RESULTS

The mean age of adolescents was 12.47 years (SD: ± 3.29 years), with a prevalence of genital abnormalities of 24.46 %, corresponding to 23 patients. Varicocele was the most prevalent GA and 26.08 % of them were found in the maximum category of Tanner's stage of sexual maturation. These results are shown in the table.

ISSN 2707-9120

Table. Genital abnormalities in young soccer players form Guinea Bissau

Genital abnormalities		Prevalence		95 % Confidence Interval	Age	Tanner's stage				
		No.	%			1	2	3	4	5
No		71	75.53	-	7-18	83	13	17	15	18
Yes n=23	Varicocele	13	13.83	11.48-16.18	9-17	2	1	2	4	4
	Phimosis	4	4.26	2.83-5.68	7-11	1	2	1		
	Short frenulum	2	2.13	1.26-2.99	9-16		1			1
	Hydrocele	2	2.13	1.26-2.99	8-17	1				1
	Hypospadias	1	1.06	0.71-1.42	8	1				
	Monorchia	1	1.06	0.71-1.42	13				1	

DISCUSIÓN

The medical examination, particularly in the area of sports, is aimed at discovering and approaching health problems that could interfere with sports performance; therefore, a favorable health status is ultimately certified for such practice. The systematic medical examination performed to sportsmen and women is recommended by different medical organizations, given the scientific evidence that associates physical activity and sports with the reduction of overall mortality.[11]

Congenital defects, congenital abnormalities, or congenital alterations are the terms used to refer to a wide group of diseases with alterations in morphogenesis that are caused by alterations in the embryonic and/or fetal development, including any type of error in its development either physical, psychic, functional, sensory, or motor. Genital abnormalities constitute about 9.3 % of the total of congenital malformations.[3,5,6]

Varicocele was found to be the most frequent genital abnormality. It is known as a frequent vascular anomaly that affects 15-20 % of the male adult population.[2,12] Esteves et al.[13] report that its appearance is more common in young, tall, and thin men with a low body mass index. The causal relationship between obesity and varicocele is a matter of debate since there is a great cohort of overweight/obese men who suffer from this condition.

In a meta-analysis, *Xiao Bing et al.*[12] concluded that overweight or obesity reduce the risk of varicocele. However, it increases with underweight, having realized that the obese group vs the normal weight group had a lower risk of varicocele (odds ratio 0·46; 95 % confidence intervals 0·37- 0·58). The overweight group vs the normal weight group had a protective effect against varicocele (OR 0·70; 95 % CI 0·56 -0·86) and the underweight group vs normal weight group had a 30 % higher risk of varicocele (OR 1·31; 95 % CI 1·04-1·64). These authors also explain that their findings refer to an association rather

than a causal relationship since critical confounding factors (operator-depending diagnostic experience, patient selection criteria, and diagnostic method) were not taken into account. Other authors such as *Míguez Fortes et al*.[14] together with *Peña Criollo et al.*,[15] agree that varicocele may occur more frequently in tall and thin patients.

Monaco et al.[9] confirmed that sports practice is a physical activity contrary to the increase in the prevalence of varicocele, nevertheless, subclinical varicocele does have a higher rate of progression to clinical varicocele. These authors cite the research carried out by Di Luigi et al., where it was found that both athletes and non-athletes had decreased sperm motility and morphology, without altered hormone levels, and decreased testicular volume in comparison with the general population. The athlete group had a significantly smaller testicular size compared to the contralateral one. These results prevent us from concluding that competitive sport could be considered as an aggravating factor in the pathogenesis of seminal alterations related to varicocele.

Phimosis or the inability to retract below the glans was diagnosed in 4.26 % of all young athletes. *Perez Ruiz A*[16] argues that about 10 % of boys older than 3 - 4 years, and 1 to 9 % of all men under 18 years of age suffer from it. Its etiology includes aspects such as narrow foreskin, adhesions between the foreskin and the glans, balanitis, and short frenulum, among others. The suffering of phimosis includes the appearance of complications such as balanitis, discomfort during urination, difficulties or discomfort during intercourse, and even the possibility of presenting penile cancer. Surgery is performed for its resolution, resulting in the most widely used and accepted treatment, also having the best results. Phimosis does not limit sports activities, so it is not included in the list of prohibitions for entry into military or sports forces.

The short frenulum, which is recognized as the ventral deviation of the glans or when the foreskin is retracted, was diagnosed in 2.13 % of the total of subjects studied.[2] *Villarreal Valerio JA*[17] states that, even though this morphological condition of the preputial frenulum limits the movement of the foreskin, it stretches during erection, causing a partial or complete rupture or even a crack, thus producing an intense burning sensation and pain. It is clinically relevant as a common cause of dyspareunia. This author recognizes up to 50 % prevalence, and a treatment focused on performing frenectomy.

Hydrocele was diagnosed in 2.13 % of all athletes. Hydrocele or accumulation of peritesticular fluid in the tunica vaginalis can be congenital or acquired. In adolescents, underlying processes should be ruled out by performing a thorough anamnesis and making a complete physical examination.[8] *Delgado Burgos et al.*,[18] together with *Zavala et al.*,[19] agree that hydrocele is one of the most frequent reasons for consultation in urology, with a normally benign and clinically asymptomatic course in most cases. The nature of the disease itself leads to the mistake of neglecting treatment or postponing it for a long time. Complications of the disease are rare and it does not constitute a criterion of exemption from work or physical exertion.[20]

Hypospadias and monorchia were diagnosed in 1.06 % of all athletes. Hypospadias is the most frequent congenital male genital malformation in children, with an incidence of 1 in 250 male newborns. The genetic component of the disease is frequent, given that 5-10 % have a family history, coinciding with 18 and 50 % in twins.[3,8] *Arboleda Bustan et al.*[22] defend the need of surgical treatment between 6 and

18 months of age. Such indication usually corresponds to cases with alterations in the micturition process, fan-like micturition or non-linear urinary stream, impossibility to urinate in standing position, significant penile curvature that makes penetration difficult during sexual intercourse, infertility associated with abnormalities of semen deposition, and the desire of the patient due to esthetic dissatisfaction. Although hypospadias has an important psychological effect on self-esteem and sterility of the urinary tract, it does no influence on the practice of sports or physical exertion[4]. According to *Reyes Ruiz et al.*[23], monorquia or unilateral testicular agenesis is part of the so-called undescended testicles which affects more than 3 % of children born at term and up to 33 % of preterm newborns. The right testicle is absent by up to 70 % of unilateral cases. Its diagnosis is only certain by performing tomographic studies, but monorchia does not constitute a criterion for not practicing sports, even in the case of high performance athletes.

The evaluation of male puberty is based on the examination of the external genitalia and the Tanner´s scale is the instrument that allows to visually estimate the morphological changes of the external genitalia (G) and pubic hair (P) stages, in five stages. The first stage corresponds to the prepubertal stage; stages two, three and four, to puberty´s course; and stage five, to complete puberty. No dissociation between Tanner´s stage and age was found among all the athletes, so genital abnormality had no influence on the genital development of athletes. According to Agüero et al.[24], Tanner´s stage one refers that the great variability in the onset, the speed and magnitude of pubertal changes, the reference values for the stages of pubertal development, and the testicular volume obtained only on the basis of age, have a very wide range since there are healthy boys between 13 and 14 years old who could have almost any stage of genital development (G1-5).

The impossibility of measuring testicular volume due to the lack of a Prader Orchidometer is a limitation of the study.

In conclusion, the incidence of genital abnormalities in young soccer athletes in Guinea Bissau was in accordance with international reports, and the genital examination is more related to the biological health of the individual than sports skills and performance.

REFERENCES

1. Corona G, Bianchi N, Prontera O, Ferri S, Dicuio M, Concetti S, et al. Medical and Surgical Treatment of Congenital Anomalies of Male Genital Tract. In: Foresta C, Gianfrilli D (eds). Pediatric and Adolescent Andrology. Trends in Andrology and Sexual Medicine. Springer, Cham. 2021. Available from: https://doi.org/10.1007/978-3-030-80015-4_4

2. Beltré Núñez E. Malformaciones urológicas asociadas a desarrollar enfermedad renal crónica en niños del departamento de urología, en el Hospital Infantil Dr. Robert Reid Cabral, Agosto 2018-Febrero 2019 [Tesis]. República Dominicana: Universidad Nacional Pedro Henríquez Ureña; 2019. Disponible en: https://repositorio.unphu.edu.do/handle/123456789/1403

3. Cárdenas Chávez AB, Rueda Moyota ME. Prevalencia de malformaciones congénitas mayores en niños nacidos vivos de 0 a 2 años de edad en el Hospital Roberto Gilbert durante el periodo 2018 - 2019 [Tesis]. Ecuador: Universidad Católica de Santiago de Guayaquil; 2020. Disponible en: http://repositorio.ucsg.edu.ec/handle/3317/15465

4. Corrales Sánchez C, Gallardo Carvajal A, Borenstein Guelman M. Hipospadias: del diagnóstico ecográfico prenatal al manejo posnatal. Rev Chil Obstet Ginecol. [Internet]. 2023;88(1):71-83. Acceso: 15/8/2023. Disponible en: http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-75262023000100071&lng=es

5. López Soto Á. Anomalías genitales: contextualización de un campo olvidado en el diagnóstico prenatal. Rev Colomb Obstet Ginecol [Internet]. 2020;88(1):71-83. Acceso: 15/8/2023. Disponible en: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0034-74342020000300006&lng=en

6. Wu W, Gitlin J. The Male Genital System. Pediatr Rev [Internet]. 2020;41(3):101-11. Acceso: 15/8/2023. Disponible en: https://doi.org/10.1542/pir.2017-0316

7. Santamaria Durán N, Suárez Obando F, Rojas Moreno A. Trastornos del desarrollo sexual asociados a los cromosomas sexuales: Una actualización. Rev Mex Urol [Internet]. 2022;82(4):e05. Acceso: 15/8/2023. Disponible en: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2007-40852022000400005&lng=es

8. Espinoza Vega ML. Trastornos urológicos en el varón adolescente. Adolescere. [Internet]. 2019;VII(3):45-50. Acceso: 15/8/2023. Disponible en: https://www.adolescere.es/revista/pdf/volumen-VII-n3-2019/2019-n3-45_Tema-de-revision-Trastornos-urologicos--varon-adolescente.pdf

9. Mónaco M, Verdugo F, Bodell M, Avendaño E, Tila L, Drobnic F. Prevalencia de anomalías genitales en futbolistas jóvenes [Internet]. 2015;82(15):e181-e183. Acceso: 15/8/2023. Disponible en: https://doi.org/10.1016/j.anpedi.2014.07.007

10. Jáuregui Leyes P, Gaete L, Ponczosznik MD, Renzi G, et al. Consenso sobre la constancia de salud del niño y del adolescente para la realización de actividades físicas y/o deportivas. Actualización 2021. Arch Argent Pediatr. 2021;119(5):S212-S221. Acceso: 15/8/2023. Disponible en: https://www.sap.org.ar/uploads/consensos/consensos_consenso-sobre-la-constancia-de-salud-del-nino-y-del-adolescente-para-la-realizacion-de-actividades-fisicas-yo-deportivas-actualizacion-2021-120.pdf

11. Directrices de la OMS Sobre Actividad Física y Comportamientos Sedentarios. Geneva: World Health Organization; 2021. Available from: https://www.ncbi.nlm.nih.gov/books/NBK581972/

12. Xiao Bin G, Fang Lei W, Hui X, Cheng Y, Zhi-Xuan C, Zhi Peng H, et al. The association between body mass index and varicocele: A meta-analysis. Int Braz J Urol. 2021;47:8-19. Acceso: 15/8/2023. Available from: https://doi.org/10.1590/S1677-5538.IBJU.2019.0210

13. Esteves SC, Cocuzza MS. The obesity paradox in varicocele - is the protective effect real?. Int braz j urol [Internet]. 2021;47(1):20-2. Acceso: 15/8/2023. Available from: https://doi.org/10.1590/S1677-5538.IBJU.2019.0210.1

14. Míguez Fortes L, Casal Beloy I, García González M, Dargallo Carbonell T. Varicoceles en adolescentes y su relación con el índice de masa corporal: ¿son más frecuentes en varones altos y delgados? Cir Pediatr [Internet]. 2019;32(3):141-4. Acceso: 15/8/2023. Disponible en: https://secipe.org/coldata/upload/revista/2019_32-3_141-144.pdf

15. Peña Criollo LC, Parra Rosero AC. Varicocele: nuevos enfoques diagnósticos y terapéuticos. Ciencia Latina [Internet]. 2022;6(6):6096-113. Acceso: 15/8/2023. Disponible en: https://ciencialatina.org/index.php/cienciala/article/view/3861

16. Pérez Ruiz, A. Comportamiento clínico y epidemiológico de fimosis congénita y adquirida. Metaanálisis [Tesis]. Ecuador: Universidad Católica de Cuenca; 2023. Disponible en: https://dspace.ucacue.edu.ec/handle/ucacue/14340

17. Villarreal Valerio JA. Dispareunia masculina. An Fac Med. [Internet]. 2019;80(1):79-85. Acceso: 15/8/2023. Disponible en: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1025-55832019000100015&lng=es

18. Delgado Burgos TB, Ortiz Jumbo TT, Montalvo Escobar LM, Macías Hidrovo CK, Bajaña León RD. Escroto agudo urgencia en niños y adolescentes. Publicación Científica del Vicerrectorado Académico de la Universidad Técnica de Babahoyo [Internet]. 2021;5(3):46-59. Acceso: 15/8/2023. Disponible en: https://revistas.utb.edu.ec/index.php/rpa/article/view/2599

19. Zavala GL, Sauceda Meza RM, Montoya Reales DA. Hidrocele en niños: diagnóstico y tratamiento. Rev Fac Cienc Méd. (Impr.). 2020;17(1):38-42. Acceso: 15/8/2023. , ene.-jun. 2020. esisGonzález-González A, Casado-Méndez P, Molero-Segrera M, Santos-Fonseca R, López-Sánchez I. Factores asociados a depresión posparto. Archivo Médico Camagüey [Internet]. 2021;23(6):[aprox. 9 p.]. Acceso: 15/4/2023. Disponible en: https://revistaamc.sld.cu/index.php/amc/article/view/6631

20. Sancho Gil L, Mallor López E, Sancho García MM, Herranz Medina CC, Garcés Cardós MT, Valer Pelarda AC. Desarrollo de un protocolo de recuperación multimodal en el tratamiento quirúrgico del Hidrocele. Revista Sanitaria de Investigación [Internet]. 2021;2(10). Acceso: 15/4/2023. Disponible en: https://revistasanitariadeinvestigacion.com/desarrollo-de-un-protocolo-de-recuperacion-multimodal-en-el-tratamiento-quirurgico-del-hidrocele/

21. Germani M, Fiuza Pérez MD, Sánchis Solera L, Hernández González L, García Hernández JA. Disruptores endocrinos e hipospadias en Gran Canaria (2012-2015). Rev Esp Salud Pública [Internet]. 2018;92:e20180855. Acceso: 15/4/2023. Disponible en: https://www.scielosp.org/article/resp/2018.v92/e20180855/es/#

22. Arboleda Bustan JE, Molina M, García-Andrade J, Flores-Nuñez M, Vicuña Pozo MF, Yépez Hidalgo A, Cuadras D. Seguimiento de los pacientes con hipospadias tratados en el Hospital Pediátrico Baca

Ortiz 2020 al 2022. MetroCiencia [Internet]. 2023;30(1):7-13. Acceso: 15/4/2023. Disponible en: https://revistametrociencia.com.ec/index.php/revista/article/view/499

23. Reyes Ruiz VI, Riera Chérrez BF, Mina Chalar JS, Ramírez Holguín JG, Cozzarelli Cabezas RR. Testiculos no descendidos: pautas actuales de tratamiento. Publicación Científica del Vicerrectorado Académico de la Universidad Técnica de Babahoyo [Internet]. 2020;4(4):71-80. Acceso: 15/4/2023. Disponible en: https://revistas.utb.edu.ec/index.php/rpa/article/view/2533

24. Agüero G, Berner E. Estadios de Tanner y orquidometría de Prader en varones adolescentes. Estudio descriptivo transversal. Arch Argent Pediatr. [Internet]. 2023;121(2):e202202717. Acceso: 15/4/2023. Disponible en: https://www.sap.org.ar/docs/publicaciones/archivosarg/2023/v121n2a05.pdf

Conflict de interests

The authors have no conflicts of interest to declare.

Authors' contributions

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Received: 20/08/2023.
Approved: 31/08/2023.