Open Access Indonesian Journal of Medical Reviews

Journal Homepage: https://hmpublisher.com/index.php/OAIJMR

Analysis of Studies on the Role of Hormones in Micropenis Disorders: A Systematic Literature Review

Rizki Jaya Amal[1*], Irfansyah[1], Muhammad Arif Hasan[1], Aulia Putra Rahman[2]

[1]Teungku Peukan General Hospital, Southwest Aceh, Indonesia

[2]Teuku Umar General Hospital, Aceh Jaya, Indonesia

ARTICLE INFO

Keywords:
Aspect
Hormonal
Micropenis
Study

***Corresponding author:**
Rizki Jaya Amal

E-mail address:
rizkyjayaamal@gmail.com

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/oaijmr.v3i6.420

A B S T R A C T

A deep understanding of the role of specific hormones in genital development is key to designing effective therapeutic approaches. Factors such as testosterone deficiency, growth hormone disorders, or other hormonal imbalances can be targets for hormonal interventions that can affect penis size. This study aimed to explore the role of hormonal aspects in micropenis disorders. The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the role of hormonal aspects in micropenis disorders. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations. Aspects of the hormonal role in micropenis include several key elements that influence the development of genital organs in men. Hormones, such as testosterone, growth hormone, estrogen, and dihydrotestosterone (DHT), play an important role in stimulating penis growth and development. Proper hormonal balance is necessary for normal genital development, and disturbances in the production of or response to these hormones may contribute to conditions such as micropenis.

1. Introduction

Micropenis is a condition in which a person's penis size is smaller than the standards expected for a certain age. This condition can be influenced by various factors, including hormonal problems, which play an important role in the growth and development of the genital organs during puberty. Hormonal therapy is one of the approaches considered to treat micropenis disorders, especially when an underlying hormonal imbalance is found.[1-3]

Analysis of hormonal aspects of micropenis disorders includes stimulating the growth and development of the penis through adjusting certain hormone levels, such as testosterone and growth hormone. This study is directed at improving or correcting hormonal imbalances that may be the cause of micropenis in certain individuals. A deep understanding of the role of specific hormones in genital development is key to designing effective therapeutic approaches. Factors such as testosterone deficiency, growth hormone disorders, or other hormonal imbalances can be targets for hormonal interventions that can affect penis size.[4-6] This study aimed to explore the role of hormonal aspects in micropenis disorders.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the role of hormonal aspects in micropenis disorders. The search was performed using the terms:

(1) "role" OR "hormonal" OR "disorder" OR "micropenis" AND (2) "hormonal" OR "micropenis." The literature is limited to clinical studies and published in English. The literature selection criteria are articles published in the form of original articles, an experimental study on the role of hormonal aspects in micropenis disorders, studies were conducted in a timeframe from 2013-2023, and the main outcome was the role of hormonal aspects in micropenis disorders. Meanwhile, the exclusion criteria were studies that were not related to the role of hormonal aspects in micropenis disorders, the absence of a control group, and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

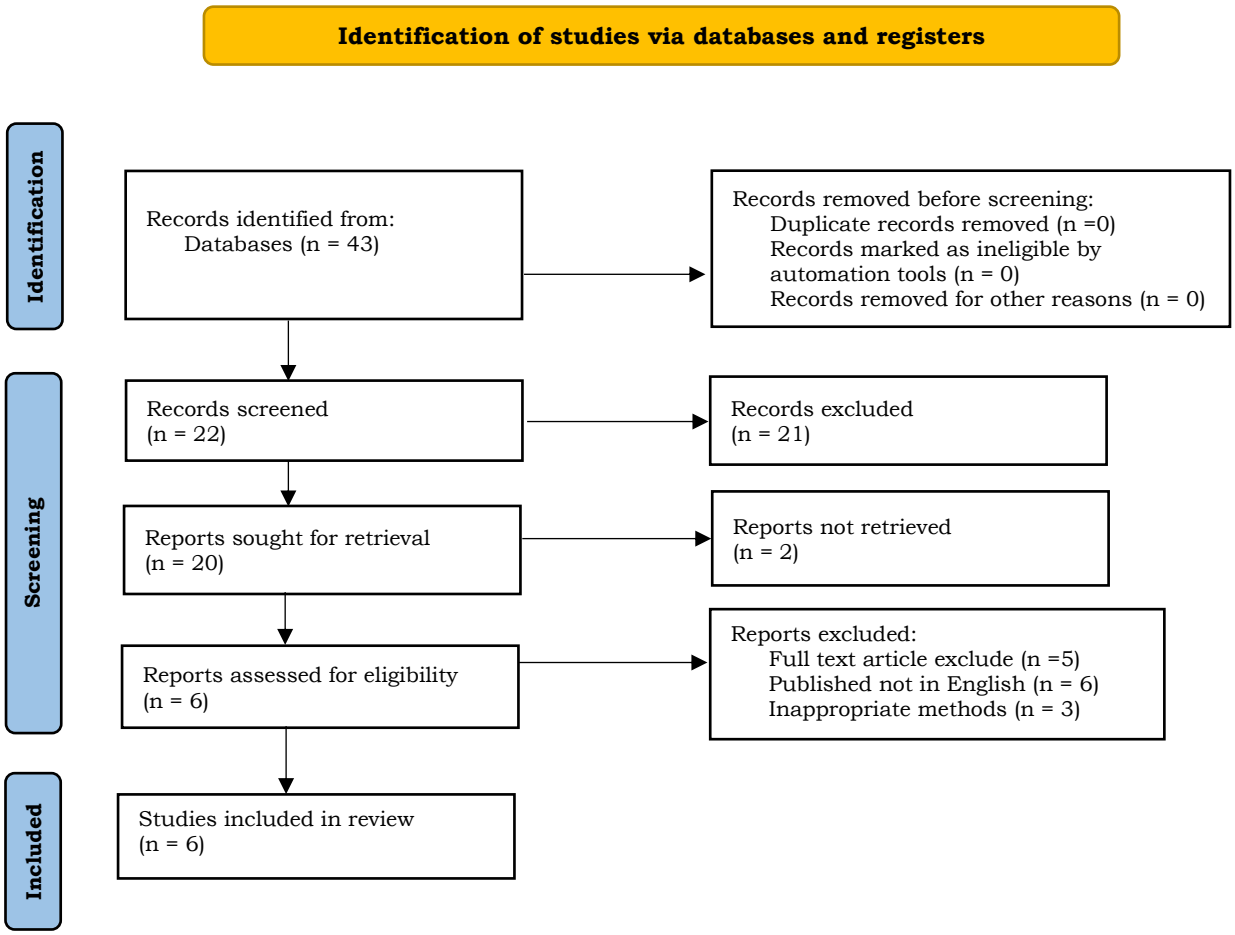

Figure 1. PRISMA flowchart.

3. Results and Discussion

Role of testosterone

Testosterone is a male sex hormone produced mainly by the testicles. This hormone has a key role in regulating and supporting various biological functions in men, including the development and function of sexual organs. Testosterone plays a role in stimulating penis growth and development during puberty. At this time, increased testosterone production triggers the growth of penile tissue and structure, resulting in an increase in the size of the organ. Testosterone plays a role in the development of male secondary sexual characteristics, such as facial hair growth, voice changes, and increased muscle mass. All of these characteristics are part of the sexual development process that is influenced by testosterone. Testosterone also contributes to the growth of pubic hair and hair in the armpits during puberty. This

hormone also influences sexual desire or libido. Increased testosterone production during puberty can influence the development of sexual desire. Testosterone is involved in the establishment and maintenance of male sexual function, including sperm production and erectile function.[7-9]

Testosterone is mainly produced by Leydig cells in the testicles. Medical conditions such as cryptorchidism (testicles that have not descended completely), testicular torsion (inversion of the testicles), infection, or injury to the testicles can interfere with testosterone production. If one or both testicles are damaged or damaged, testosterone production can decrease. The pituitary gland, located at the base of the brain, produces hormones that regulate the function of other endocrine glands, including the testicles. Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) produced by the pituitary gland stimulate testosterone production by Leydig cells in the testicles. Disorders of the pituitary gland, such as tumors or functional disorders, can inhibit the release of these hormones and cause testosterone deficiency. Some genetic conditions, such as Kallmann syndrome, involve abnormalities in the pituitary gland and hypothalamus, which can result in impaired production of hormones, including testosterone. The hypothalamus also plays a role in regulating hormone production by the pituitary gland, so disorders of the hypothalamus can also cause testosterone deficiency. Disturbances in the enzymes or chemical processes involved in testosterone synthesis can also cause a deficiency of this hormone. Examples are genetic conditions such as Klinefelter syndrome, which can produce testicles with limited function.[10,11]

During puberty in men, there is a significant increase in testosterone production, which stimulates the growth and development of the penis, as well as other secondary sexual characteristics. Testosterone plays a role in stimulating penis growth and development. This hormone triggers the proliferation and differentiation of cells within the penile tissue, causing an increase in the size and complexity of the penile structure. Increased testosterone production during puberty causes further growth of the penile shaft and enlargement of the glans. This process reaches its peak during the few years of puberty, establishing a penis size and proportions that are generally considered normal. Testosterone also contributes to the development of male secondary sexual characteristics, such as facial and body hair growth, voice changes, and muscle development. This is part of the puberty process, which is triggered by sexual hormones. Increased testosterone production during puberty also plays a role in regulating sexual desire or libido. Changes in these hormone levels can affect levels of sexual desire and sexual response.[12,13]

Role of growth hormone

Growth hormone (GH) also plays an important role in penis growth and development, especially during puberty. Growth hormone stimulates the growth of cells and tissues throughout the body, including the penis. During puberty, when growth hormone production increases, this stimulation of growth can contribute to the development and increase in penis size. Growth hormone stimulates the production of insulin-like growth factor-1 (IGF-1), a hormone that plays a role in growth and development. IGF-1 can trigger cell proliferation and increase tissue growth, including tissue in the penis. Puberty is the period when growth hormone reaches peak production. Increased production of growth hormone during this time can stimulate penis growth, reaching a more mature size and proportions. It is important to note that growth hormone works together with sexual hormones, especially testosterone, in regulating the growth and development of the genital organs during puberty. This complex interaction between various hormones plays a major role in the development of secondary sexual characteristics and penis growth.[14,15]

The role of gonadotropin hormones

Gonadotropin hormones, particularly luteinizing hormone (LH) and follicle-stimulating hormone (FSH)

have a key role in regulating the function of the gonads (reproductive organs) in men and women. In men, this hormone is very important for the regulation of testosterone and sperm production. Gonadotropin hormone imbalances can affect testosterone production and spermatogenesis and may contribute to conditions such as micropenis. Luteinizing hormone (LH) stimulates Leydig cells in the testicles to produce testosterone. Testosterone, as the main male sex hormone, has an important role in the development of sexual organs and male secondary sexual characteristics. Follicle-stimulating hormone (FSH) plays a role in stimulating spermatogenesis, namely the process of sperm formation in the testicles. Sperm are male reproductive cells that are important for reproduction. A proper balance between LH and FSH is essential to ensure testosterone production and spermatogenesis run smoothly. Imbalances or disruptions in this hormonal regulation can affect testosterone and sperm production, which can contribute to impaired development of genital organs such as micropenis. Disturbances in the production or response to gonadotropin hormones can cause hormonal imbalances that can impact the development of the genital organs, including the micropenis. For example, disorders of the pituitary gland (the pituitary gland that produces LH and FSH) or disorders of hormonal regulation in general can affect testosterone production and penis development during puberty.[16,17]

The role of the hormone estrogen

Although estrogen is generally associated with the development of female sexual organs, its presence at high levels in the male body can have a significant impact on genital development, including the penis. The balance between estrogen and testosterone is key to normal genital development in both sexes. In men, estrogen is produced in small amounts by the testes and also through the conversion of testosterone to estrogen by the enzyme aromatase. Estrogen has a role in maintaining bone health, lipid metabolism, and cardiovascular function in men. The balance between estrogen and testosterone is important for normal genital development in men. During puberty, increased production of testosterone relative to estrogen triggers penis development and growth. High estrogen levels or detrimental hormonal imbalances, for example, due to disorders of the aromatase enzyme or other hormonal problems, can inhibit penis growth during puberty. Excess estrogen or lack of testosterone can contribute to conditions such as micropenis. Proper hormonal balance is important for the development of secondary sexual characteristics, including penis size and structure. Disturbances in hormonal balance can affect the normal development process of the male genital organs.[18,19]

Role of dihydrotestosterone (DHT)

Dihydrotestosterone (DHT) plays an important role in the regulation of penile development in men. DHT is the active form of testosterone produced through the conversion of testosterone by the enzyme 5-alpha-reductase. DHT has a high affinity for androgen receptors, especially receptors in the genital area. During puberty, DHT stimulates penile growth and development by influencing the proliferation and differentiation of cells in penile tissue. DHT helps in the differentiation of cells in the penis, including cells in the cavernosal and corpus spongiosum, which are parts of the structure of the penis. DHT plays a role in regulating penis size and strength. Increased production of DHT during puberty contributes to increased penis size and development.[20]

4. Conclusion

Aspects of the hormonal role in micropenis include several key elements that influence the development of genital organs in men. Hormones, such as testosterone, growth hormone, estrogen, and dihydrotestosterone (DHT), play an important role in stimulating penis growth and development. Proper hormonal balance is necessary for normal genital development, and disturbances in the production of or response to these hormones may contribute to conditions such as micropenis.

5. References

1. Lee PA, Houk CP, Ahmed SF, Hughes IA. Consensus statement on management of intersex disorders. Pediatrics. 2016; 118(2): e488-500.
2. Hughes IA, Werner R, Bunch T, Hiort O. Androgen insensitivity syndrome. Semin Reprod Med. 2022; 30(5): 432-42.
3. Grumbach MM, Conte FA. Disorders of sex differentiation. In: Larsen PR, Kronenberg HM, Melmed S, Polonsky KS, eds. Williams Textbook of Endocrinology. 12th ed. Philadelphia, PA: Saunders; 2021: 842-1002.
4. Cohen-Kettenis PT, Dessens AB. Gender change in 46, XY persons with 5alpha-reductase-2 deficiency and 17beta-hydroxysteroid dehydrogenase-3 deficiency. Arch Sex Behav. 2020; 39(1): 83-94.
5. Sinclair AH, Berta P, Palmer MS, Hawkins JR, Griffiths BL, Smith MJ, et al. A gene from the human sex-determining region encodes a protein with homology to a conserved DNA-binding motif. Nature. 2020; 346(6281): 240-4.
6. Quigley CA, De Bellis A, Marschke KB, el-Awady MK, Wilson EM, French FS. Androgen receptor defects: historical, clinical, and molecular perspectives. Endocr Rev. 2015; 16(3): 271-321.
7. Ahmed SF, Khwaja O, Hughes IA. The role of a clinical score in the assessment of ambiguous genitalia. BJU Int. 2020; 85(1): 120-4.
8. Rey RA, Belville C, Nihoul-Fékété C, Michel-Calemard L, Forest MG, Lahlou N. Evaluation of gonadal function in 107 intersex patients by means of serum antimüllerian hormone measurement. J Clin Endocrinol Metab. 2019; 84(2): 627-31.
9. Cools M, Drop SL, Wolffenbuttel KP, Oosterhuis JW, Looijenga LH. Germ cell tumors in the intersex gonad: old paths, new directions, moving frontiers. Endocr Rev. 2016; 27(5): 468-84.
10. Oakes MB, Eyvazzadeh AD, Quint E, Smith YR. Complete androgen insensitivity syndrome--a review. J Pediatr Adolesc Gynecol. 2018; 21(6): 305-10.
11. Witchel SF, Lee PA. Disorders of sex development. In: Sperling MA, ed. Pediatric Endocrinology. 4th ed. Philadelphia, PA: Saunders; 2014: 663-705.
12. Hiort O. Androgens and puberty. Best Pract Res Clin Endocrinol Metab. 2022; 16(1): 31-41.
13. Rey RA, Josso N. Fine-structure of sex cord-stromal tumors in two patients with the persistent Müllerian duct syndrome. Am J Clin Pathol. 2022; 97(3): 360-7.
14. Mazen IA, Hiort O. Management of gonadotropin-dependent precocious puberty. Best Pract Res Clin Endocrinol Metab. 2022; 16(1): 155-71.
15. Audi L, Ahmed SF, Krone N, Cools M, McElreavey K, Holterhus PM, et al. Genetics in endocrinology: approaches to molecular genetic diagnosis in the management of differences/disorders of sex development (DSD): position paper of EU COST Action BM 1303 'DSDnet'. Eur J Endocrinol. 2018; 179(4): R197-R206.
16. Rey R, Lordereau-Richard I, Carel JC, Barbet P, Cate RL, Roger M, et al. Anti-Müllerian hormone and testosterone serum levels are inversely during normal and precocious pubertal development. J Clin Endocrinol Metab. 2013; 77(5): 1220-6.
17. Lee PA, Nordenström A, Houk CP, Ahmed SF, Auchus R, Baratz A, et al. Global disorders of sex development update since 2006: perceptions, approach and care. Horm Res Paediatr. 2016; 85(3): 158-80.
18. Daujat S, Bauer U-M, Shah V, Turner B. Poly (ADP-ribose) polymerase activity in porcine tissues: role in nucleotide excision repair. J Biol Chem. 2021; 276(21): 1794-801.

19. Méndez JP, Ulloa-Aguirre A, Imperato-McGinley J, Ortiz de Luna RI, Torres-Salazar A, Ulloa-González C, et al. Male pseudohermaphroditism due to primary 17,20-lyase deficiency--genotype, phenotype, and gender identity. J Clin Endocrinol Metab. 2013; 88(6): 2760-8.
20. Josso N, Belville C, di Clemente N, Picard JY. AMH and AMH receptor defects in persistent Müllerian duct syndrome. Hum Reprod Update. 2015; 11(4): 351-6.