Original article

Impact of Men with Undescended Testis on Fertility and Hormonal Function Promoting Hypogonadism

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Abstract:

Objectives: Undescended testes or cryptorchidism is a disorder in men and is associated with hypogonadism and infertility. UDT is the majority factor in male adults. Studies on the effects of UDT on hormone-associated hypogonadism are limited. ***Materials and Methods:*** This study aimed to assess the effects of UDT on fertility and testicular hormonal function in adult men. Data from medical records were gathered, laboratory tests, and retrospective interviews from 2018 to 2020. The independent variable was men with UDT, while the dependent variable was fertility and reproductive hormones that trigger hypogonadism. Data on infertility, reproductive hormones, semen analysis, and symptoms of hypogonadism from 20 patients with and without UDT. ANOVA, Kruskal-Wallis test, Pearson chi-square test, and Fisher's exact test helped perform the analysis. ***Results and Discussion****:* Undescended testes were associated with infertility so that levels of FSH and LH were considerably greater than men without UDT ($p < 0.05$). Bilateral UDT men had the highest levels of FSH and LH but not significantly different from unilateral UDT ($p > 0.05$). Bilateral UDT men had the lowest mean estradiol, testosterone and sperm quality ($p < 0.05$). All men had prolactin and AMH levels within normal limits ($p > 0.05$). Men with UDT had more significant hypogonadal symptoms ($p < 0.001$) ***Conclusion****:* Infertility, FSH, and LH levels were highest in men with bilateral UDT, but testosterone and estradiol levels were lowest. It also has the worst sperm quality and the most hypogonadal symptoms. All of the men had normal prolactin and AMH levels

Keywords: *Cryptorchidism; hypogonadism; infertility, sperm analysis; undescended testis*

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Introduction:

Undescended testes (UDT) occur when the testes permanently fail to descend.[1] Undescended testes are frequently found in one-third of preterm male newborns with at least one side, called unilateral UDT, and a 2–8% incidence in normal newborn boys.[1,2] The prevalence of unilateral UDT was four times more likely than bilateral UDT.[2] Undescended testes have an impact on the quality of men's sperm; men with a history of bilateral UDT have a significantly lower sperm concentration compared with normal men or unilateral UDT men.[3] The prevalence of azoospermia is also increased in UDT, that is, 13% in unilateral UDT men, and the percentage increased

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to 89% in untreated bilateral UDT men, which leads to UDT being the most typical cause of azoospermia in UDT adults.[4]

Over the last two decades, UDT cases as male factor infertility were growing. New management approaches are being developed at a rapid pace in handling UDT has enabled the ability to become fathers, who previously Several of these men were thought to be infertile. However, process evaluation of the results of management approaches often gives inconsistent results due to various factors that affect fertility itself and hormonal function related to hypogonadism.[4] The inconsistent results of management are also influenced by the definitive etiology of UDT which remains unknown and the anomaly is considered multifactorial including anatomical, endocrine, environmental, genetic, and mechanical factors.[5] Undescended testes have a close correlation with infertility as well as testicular malignancy. The abdominal cavity's temperature and the groin canal is almost 2°C higher than the scrotum, it is possibly the reason why spermatogenesis is impeded and germ cells are harmed.[6] In addition, it was found that the number of Leydig cells in UDT was reduced and could cause infertility.[5]

It is evident that the risk of infertility and testicular germ cell tumors (TGCT) are consistently higher for men with a history of UDT. However, to our best knowledge, studies on the long-term effects of UDT on hormones and hypogonadism in UDT adults are limited and have inconsistent results. Several studies have shown that men with a UDT history have higher FSH and LH hormones but normal testosterone levels compared with men without UDT history.[7] However, other studies have noted low testosterone levels and high LH concentrations in adults with a UDT history.[8]

Low levels of testosterone will cause hypogonadism, which is a medical condition where the functional activity of the gonads, which produce hormones (testosterone, estradiol, antimullerian hormone/ AMH) and gametes (eggs or sperm) is decreased. Hypogonadism's signs and symptoms include weakness, decreased or loss of libido, depressed mood, unproductiveness, low muscular mass, high body fat percentage, and low bone density.[3 ,9]

Various results in hormonal features related to fertility and hypogonadism pose a challenge in the treatment of couples wanting children with UDT husbands. Workers who are exposed to radiation are at risk of reproductive health problems such as infertility and congenital malformations[10] . A study shows that infertility in men is not only influenced by hormones. Factors such as alcohol, tobacco, obesity, age, stress and psychological disorders have an impact on male infertility.[11] This study aims to compare data with men in the control group in order to describe the evidence on fertility with previously bilaterally UDT men. with unilateral UDT and non UDT. Using a retrospective method, the summary of data from unilateral cases is as well as, making bilateral comparisons, unilateral, and non UDT are also presented. An overview of UDT male fertility in adulthood can be provided by a comparative presentation of bilateral, unilateral, and non-UDT data. The findings of this study can be used to help determine the best treatment for men with UDT. This effective treatment can help UDT men become more fertile.

Methods:

This research is cross-sectional that aimed to evaluate fertility and hormonal function promoting hypogonadism in UDT men husbands. Men with both UDT unilateral and bilateral were initially discovered through an examination of medical records. Furthermore, they were called on the phone or email and asked for their willingness to be study participants. If the participants agree to be involved in this study, they would have laboratory tests and an interview to get the data needed by researchers. The men comprised 23 patients with unilateral UDT, 25 patients with bilateral UDT, and 20 patients with ectopic testes from a retrospective study between the years of 2018 and 2020 at Reproductive Clinic, Asri Medical Centre Muhammadiyah Hospital Yogyakarta, Indonesia. However, 3 patients from unilateral UDT and 5 patients from bilateral UDT groups were dropped out because they rejected for further tests and interviews.

Characteristics of men with UDT and ectopic testes that were being reviewed included BMI, age, alcohol drinking history, and smoking habit history. Fertility rates, hormonal functions (FSH and LH, testosterone, estradiol, prolactin, and AMH), symptoms of hypogonadism (low libido, low morning erection, and lean body), and sperm analysis (total sperm, sperm concentration, viability, and immotility) were analyzed in this study.

Inclusion criteria were patients who agreed to involve as respondents, patients with reproductive infertility

problems, husbands with UDT, and marriage age more than 1 year. The exclusion criteria are patients who rejected to be respondents and patients who had never taken any infertility programs. Participants with a history of pituitary or hypothalamic disorders, varicocele, and a history of reproductive organ malignancies were also excluded from the study.

The investigations had been approved by the Ethical Committee of Faculty of Medicine, Universitas Gadjah Mada/Dr. Sardjito Hospital (KE/FK/0783/EC/2021).

Data Collection

Physical examination in the form of calculated body mass index (BMI) was carried out. A method called ELISA (enzyme-linked immunosorbent assay) was used for measuring serum testosterone and estradiol, while fluoroimmunoassay was used for calculating the serum concentrations of FSH, LH, prolactin, and AMH. The analysis of semen was carried out in accordance with a guideline from WHO (2010).[12] consisting of ejaculation volume, sperm concentration, motility, and morphology. For retrospective evaluation, the 2010 WHO reference was used in all cases and controls.[12]

Statistical Analysis

Numerical data were reported as mean (SD), median, and range, whereas categorical data were presented as frequencies (percentage). To compare the three groups of numerical variables, it was used as a statistical analysis of variance (ANOVA). Kruskal-Wallis test was applied as an alternative if the data were not normally distributed.

Pearson's chi-square test was used to compare categorical data across the three groups. If the assumption of Pearson's chi-square test was not being met, Fisher's exact test was applied. A p-value < 0.05 were considered statistically significant.

Ethical Clearance:

The Ethical Committee of the Faculty of Medicine, Universitas Gadjah Mada/Dr. Sardjito Hospital has approved this study (KE/FK/0783/EC/2021). Written informed consents were obtained from all patients for participating in this study.

Result:

Participants are men aged between 20 and 40 years old, with a BMI between 19 and 39.5 kg/m^2. Participants had a history of UDT and had received either hormonal or surgical treatment before 1 year of age.

Table 1. Characteristics of respondents

Characteristics	Unilateral UDT (N=20)	Bilateral UDT (N=20)	No UDT (N=20)	*p value*
BMI				
18.5-24.9kg/m^2	12 (60%)	5 (25%)	19 (95%)	
25-29.9 kg/m^2	5 (25%)	15 (75%)	1 (5%)	
≥ 30 kg/m^2	3 (15%)	-	-	
Mean	25.78 ± 4.60	25.75 ± 2.56	22.18 ± 1.56	
Age group				
20-30 years	15 (75%)	14 (%)	17 (85%)	
31-40 years	5 (25%)	6 (30%)	3 (15%)	
Mean	27.50 ± 3.50	28.70 ± 3.97	26.50 ± 2.48	0.083
Smoking habit	5 (25%)	7 (35%)	6 (30%)	0.788
Alcohol consumption	4 (20%)	2 (10%)	2 (10%)	0.562
Infertility	14 (70%)	18 (90%)	9 (45%)	0.009

According to Table 1, regarding age, there are no notable disparities between the three categories. (p 0.083), with the mean of age ranging between 26 and 28 years old. The BMI mean shows that men with unilateral and bilateral UDT are in the overweight category, 25.78 and 25.75, respectively, while men without UDT are in the normal category of BMI (22.18). There is no statistically significant difference in the three groups regarding the percentages of men who admitted to smoking and who have a history of drinking alcohol with the p-value of 0.788 and 0.562, respectively.

Undescended testes have a significant association with infertility, where high infertility rates are associated with bilateral UDT, followed by unilateral UDT. Whereas, men without UDT are less frequently experiencing infertility (Table 1)

Table 2. Comparison endocrine function in all groups

Hormonal status	Unilateral UDT (N=20)	Bilateral UDT (N=20)	No UDT (N=20)	*p* value all group	*p* value unilateral vs normal	*p* value bilateral vs normal	*p* value unilateral vs bilateral
FSH level Normal (1.5-18.1 mIU/mL)	9 (45%)	7 (35%)	20 (100%)	< 0.001	0.002	< 0.001	1.00
Increased	11 (55%)	13 (65%)	-				
Mean	22.88 (± 10.27)	26.62 (± 15.85)	12.68 (± 2.77)				
LH levels Normal (1-10 mIU/mL)	9 (45%)	7 (35%)	20 (100%)	< 0.001	0.035	< 0.001	0.214
Increased	11 (55%)	13 (65%)	-				
Mean	14.17 (± 9.54)	18.61 (±10.12)	6.66 (±1.74)				
Testosterone Normal (10.5-35 nmol/L)	13 (65%)	6 (30%)	20 (100%)	0.003	0.744	0.003	0.089
Decreased	7 (35%)	14 (70%)	-				
Mean	21.78 (± 17.12)	12.96 (± 10.39)	19.92 (± 5.14)				
Estradiol Normal (7.63-42.6 pg/mL)	18 (90%)	20 (100%)	20 (100%)	0.000	0.728	< 0.001	0.014
Low	2 (10%)	-	-				
Mean	19.29 (± 8.48)	12.83 (± 4.46)	21.32 (± 6.22)				
Prolactin Normal (2-18 mg/mL)	17 (85%)	20 (100%)	20 (100%)	0.057			
Low	3 (15%)	-	-				
Mean	6.47 (± 4.53)	8.42 (± 3.82)	9.50 (± 3.17)				
AMH Normal (5-27 pg/L)	9 (45%)	6 (30%)	9 (45%)	0.677			
Low	11 (55%)	14 (70%)	11 (55%)				
Mean	7.67 (± 7.11)	5.44 (± 4.58)	7.28 (± 5.83)				

According to Table 2, increased FSH levels were found at 65% of men with bilateral UDT and 55% men with unilateral UDT. No men without UDT had FSH levels above normal limits. Increased LH levels were found in 65% of men with bilateral UDT and 55% of men with unilateral UDT and not found in men without UDT. Men with bilateral UDT had a significantly higher mean of FSH and LH levels than men without UDT ($p < 0.001$) but not significantly different than unilateral UDT men (p 1.00). Unilateral UDT men had significantly higher levels of FSH and LH than men without UDT (p 0.002). The mean of FSH and LH levels in men with UDT exceeded normal limits.

Bilateral UDT men had significantly lower rates of testosterone than men without UDT (p 0.003). Although bilateral UDT men had the lowest mean of testosterone, it was not significantly lower than unilateral UDT men (p 0.089). Unilateral UDT men had a lower mean of testosterone than men without UDT, but it was not significant (p 0.744). However, as many as 70% of bilateral UDT men had a testosterone level below normal, 35% of men with unilateral UDT had a testosterone level below average, and only 5%

of men without UDT had a testosterone level below normal. Men with bilateral UDT had the lowest mean of estradiol and significantly lower than men with unilateral UDT as well as men without UDT, with the p-value of 0.014 and < 0.001, respectively. Men with unilateral UDT had a lower mean of estradiol compared with men without UDT, but it was not significant (p 0.728). The mean of prolactin (p 0.057) and AMH (p 0.677) did not differ significantly among men with unilateral UDT, bilateral UDT, and men without UDT. All men had mean prolactin and AMH levels within normal limits.

Table 3. Comparison of symptoms of hypogonadism between men with unilateral UDT, bilateral UDT, and men without UDT

Symptoms	Unilateral UDT (N=20)	Bilateral UDT (N=20)	No UDT	*p* value
Decreased libido				
Yes	10 (50%)	15 (75%)	0 (0%)	0.001
No	10 (50%)	5 (25%)	20 (100%)	
Morning erection				
Yes	14 (70%)	6 (30%)	19 (95%)	<
No	6 (30%)	14 (70%	1 (5%)	0.001
Lean body mass				
Yes	6 (30%)	12 (60%)	0 (0%)	<
No	13 (70%)	8 (40%)	20 (100%)	0.001
Breast growth				
Normal	16 (80%)	13 (65%)	19 (95%)	0.06
Abnormal	4 (20%)	7 (35%)	1 (5%)	

Men with UDT had significantly more hypogonadal symptoms such as low libido (p 0.001), low morning erection (p < 0.001), and a thinner body (p < 0.001) than men without UDT. Men with bilateral UDT had more significant symptoms than men with unilateral UDT. Abnormal chest growth was mostly found in men with bilateral UDT as much as 35%, followed by men with unilateral UDT by 20%, and only 5% of men without UDT had abnormal breast growth. However, this difference was not statistically significant (p 0.06) (Table 3).

Table 4 shows that total sperm below normal levels were found in 25% unilateral UDT men and 65% bilateral UDT men. All men without UDT had normal total sperm. Bilateral UDT men had a significantly lower mean of total sperm count than men without UDT (p < 0.001), but not significantly lower than unilateral UDT men (p 0.217). Unilateral UDT men had a significantly lower mean of total sperm count than men without UDT (p < 0.001).

Seventy percent of men with bilateral UDT and 10% of men with unilateral UDT had sperm concentrations below normal levels. However, 25% of men without UDT also had sperm concentrations below normal levels. Men with bilateral UDT had the lowest mean sperm concentration, however it was not substantially different from men without UDT (p 0.132). Men with unilateral UDT had a significantly higher mean sperm concentration than men with bilateral UDT (p < 0.001) and men without UDT (p 0.03). Men with bilateral UDT had a mean sperm concentration level below normal, and men with unilateral UDT and those without UDT had sperm concentration levels within normal limits.

As many as 70% of men with bilateral UDT, 65% of men with unilateral UDT, and 50% of men without a history of UDT had abnormal sperm morphology above the normal limits. The mean of normal sperm morphology in men with unilateral UDT and men with bilateral UDT were below normal limits, and there were no significant differences in all groups (p 0.266).

Men with bilateral UDT had the lowest mean of sperm viability, but there was no significant difference with men without UDT (p 0.100). Men with unilateral UDT had the highest and most significant mean of sperm viability than men with bilateral UDT (p 0.02) and men without UDT (p 0.005). Ejaculatory volumes below normal levels were found in 20% of men with bilateral UDT, 5% of men with unilateral UDT, and not found in men without UDT. Men with bilateral UDT had the lowest mean ejaculatory volume and was significant than men without UDT (p < 0.001) but not significant compared with men with unilateral UDT (p 0.80).

The majority of UDT patients have sperm immotility above normal levels. It was noted that 95% of men with bilateral UDT as well as men with unilateral UDT had immotile sperm above normal levels, and only 5% of patients without UDT had immotile sperm above normal levels. Men with bilateral UDT had the highest and significantly higher mean of immotile sperm than men without UDT (p < 0.001), but not significantly higher than men with unilateral UDT (p 0.268). Men with unilateral UDT had a significantly higher mean of sperm immotility than men without UDT (p < 0.001). The mean immotile sperm in bilateral and unilateral UDT was above normal limits.

Table 4. Comparison of sperm analysis of all groups

Category	Unilateral UDT (N=20)	Bilateral UDT (N=20)	No UDT (N=20)	*p* value unilateral vs normal	*p* value bilateral vs normal	*p* value unilateral vs bilateral	*p* value all groups
Total sperm count							
Normal (≥ 39 million/ mL)	15 (75%)	7 (35%)	20 (100%)	< 0.001	< 0.001	0.217	0.00
Below normal level	5 (25%)	13 (65%)	-				
Mean	45.00 (± 12.44)	32.00 (± 16.32)	89.40 (± 8.19)				
Sperm concentration							
Normal (≥ 15%)	18 (90%)	6 (30%)	16 (80%)	0.03	0.132	< 0.001	< 0.001
Below normal limit	2 (10%)	14 (70%)	4 (20%)				
Mean	31.66 (± 17.04)	13.16 (± 5.19)	16.57 (± 4.18)				
Sperm morphology							
Normal (≥ 4)	7 (35%)	6 (30%)	10 (50%)				0.266
Above normal limit	13 (65%)	14 (70%)	-				
Below normal limit	-	-	10 (50%)				
Mean	3.25 (± 1.83)	3.65 (± 2.90)	4.55 (± 2.78)				
Sperm viability							
Normal (58-75%)	7 (35%)	7 (35%)	4 (20%)				
Below normal level (< 58%)	8 (40%)	5 (25%)	15 (75%)	0.005	0.100	0.02	0.001
Above normal level (> 75%)	5 (25%)	8 (40%)	1 (5%)				
Mean	63.45 (± 13.98)	46.65 (± 15.46)	47.40 (± 15.25)				
Ejaculatory volume							
Normal (1.5-4.5 cc)	19 (95%)	16 (80%)	20 (100%)	< 0.001	< 0.001	0.80	< 0.001
Below normal level	1 (5%)	4 (20%)	-				
Mean	2.28 (± 0.46)	2.17 (± 0.61)	3.54 (± 0.55)				
Sperm immotility							
Normal (< 40%)	1 (5%)	1 (5%)	19 (95%)	< 0.001	< 0.001	0.268	< 0.001
Above normal level	19 (95%)	19 (95%)	1 (5%)				
Mean	55.00 (± 12.44)	68.00 (± 16.32)	14.55 (± 10.43)				
Rapid progressive	28.65 (± 9.71)	16.00 (± 9.65)	61.10 (± 9.15)	< 0.001	< 0.001	0.51	< 0.001
Slow progressive	17.20 (± 5.56)	2.17 (± 10.02)	3.54 (± 7.84)	< 0.001	< 0.001	0.884	< 0.001

Discussion:

To investigate the effect of UDT on hypogonadism and infertility and to have the case group with the control group have the same bias, we analyzed several factors that might have influenced the outcome. We examined several factors that may be confounding factors such as age, smoking habits, and drinking habits. All confounding factors have no significant differences between all groups.

Reproductive Hormones and Semen Analysis

This cross-sectional study of the long-term effects of UDT shows found males with UDT had higher average FSH and LH levels than men without UDT. A retrospective study assessed subfertile adult men who have had UDT with subfertile men without UDT history, and it was found that the UDT groups have had higher FSH and LH levels compared with the group without UDT.[13] According to this study, men with bilateral UDT had the highest mean FSH and LH levels, and while the difference was greater than in males without UDT, it was not as great in men who had unilateral UDT. Studies conducted in Germany showed significantly higher mean LH levels in men who have experienced UDT, particularly in bilateral UDT men, compared with men without UDT.[8] A cohort study also found that men who had bilateral UDT had increased FSH and LH levels compared to the control and unilateral UDT groups.[7] The differences in the results could be due to different sample sizes because it can significantly influence the outcome of statistical analysis.[14] Noteworthy is the fact that abnormalities in sperm analysis are found in more than half of the patients with unilateral UDT, which suggests that, even if one testicle is situated in the scrotum, the disease is bilateral and may lead to infertility problems.[15] Elevated FSH levels indicate dysfunction in Sertoli cells,[16] where the cells are essential in regulating spermatogenesis and determining the capacity of sperm production.[17] Sertoli cell damage will affect the spermatogenesis process.[16]

The results of the sperm analysis indicated that men with a UDT history have poorer sperm quality. The mean of total sperm and sperm concentrations were lower with bilateral UDT and at a higher proportion. However, men with unilateral UDT still had better results than bilateral UDT in terms of mean total sperm level and sperm concentration because it had an average level above the normal limit. A review study reported that 71% of unilateral UDT men have normal sperm concentration compared with only 48% of bilateral UDT men.[15] A research carried out in Finland found a similar result where men with a history of unilateral UDT had a higher proportion of normal sperm concentration than those who have had bilateral UDT.[18] In terms of sperm motility, it was found that the differences between unilateral and bilateral UDT were insignificant., although the rate of sperm immotility was higher in bilateral UDT compared with unilateral UDT (Table 4). It is noteworthy that the WHO cut-off ranges for sperm count, motility, and morphology are poor discriminators between fertile and infertile men.[19,20] therefore, it is necessary to develop other diagnostic tests regarding sperm function when determining male infertility problems.[19] However, conception is unlikely with the low number of motile sperm.[20] Rapid and slow progressive sperm motility also have similar results on sperm immotility. Men with UDT had a lower outcome on average than men without UDT, but men with bilateral UDT were not significantly different from men with unilateral UDT. Nevertheless, the mean sperm motility outcome in men with bilateral UDT was still lower than unilateral UDT. Sperm concentration and sperm motility of men that have undergone bilateral UDT treatment in childhood were significantly lower than those with unilateral UDT.[6]

Moreover, the history of UDT does not appear to affect abnormal sperm morphology. There were no significant differences in men with a UDT history compared with no UDT, nor between bilateral UDT and unilateral UDT. Studies conducted in Slovenia also showed that there was no difference in morphology between bilateral and unilateral.[7] So that handling of UDT is necessary to analyze the semen sample. In a research on semen analysis using the 'Swim Up' Technique with Mitotracker showed that mitochondrial activity can detect a healthy sperm count.[21]

This study found that the mean level of testosterone in all men was within below normal limits. Men with bilateral UDT had a mean testosterone score that was significantly lower than men without UDT, but it was not significantly different from men with unilateral UDT. An increase in LH levels but normal testosterone levels indicate normal pituitary compensation and leydig cell malfunction.[22] The mean estradiol levels in all men sampled were within normal limits. This maybe as a result of the fact that circulating androgens and testes are converted

peripherally to produce estradiol. Estradiol also functions to inhibit androgen production in Leydig cells so that changes in estradiol are in line with plasma testosterone levels.[23] However, some studies have shown inconsistent results with estradiol levels. A study in Germany found that a history of UDT was associated with high LH levels, lower testosterone levels, and lower estradiol levels.[22] Nevertheless, a study conducted showed that men with bilateral UDT had significantly higher levels of LH, but their estradiol levels were no different from normal men.[8]

All of the men's average AMH levels fell within the normal range and did not differ significantly between all groups. To our best knowledge, only a few studies have studied AMH in UDT, especially in adult patients. However, a study found that when compared to patients without a history of UDT, those with UDT have lower AMH levels. without UDT in boys aged four years.[24]

Effect Of UDT on Hypogonadism

This study proves that the signs and symptoms of hypogonadism, including low libido, low morning erection, and lean body, correlate with a history of UDT. Men with bilateral UDT have a higher incidence of hypogonadism followed by men with unilateral UDT than normal men. Hypogonadism is also related to low testosterone levels.[25] Men with bilateral and unilateral UDT had lower testosterone levels than men without UDT, even though they were all within the normal range. Hypogonadism results from abnormal amounts of physiological concentrations of testosterone due to the pathological functioning of the testes, which produce testosterone which has an essential role in male reproductive and sexual function, metabolism, and body composition.[26]

Effect of UDT on Fertility

Fertility in adulthood is significantly affected by UDT. [2] This study showed that men with a UDT history, particularly those with bilateral UDT, had significantly lower fertility rates than normal men. Various old studies have documented a reduction in fertility rates among UDT patients using paternity rate criteria.[27] Reduced paternity rates are more frequent in men with comparing men with bilateral UDT to those with unilateral UDT and men without UDT.[28] Men with bilateral UDT are 3.5 times more frequent of being infertile than unilateral UDT men and six times riskier than men without UDT.[5,27]

The occurrence of infertility in UDT is associated with the failure to transform gonocytes to Ad spermatogonia.[29] Early in life, the conversion of neonatal gonocytes into Ad spermatogonia is impeded, and this causes a deficiency of germ cells for post-pubertal spermatogenesis and infertility.[15] infertility is affected by germ cell depletion in the abdominal testes.[30]

The disadvantage of this study was the small number of participants in both unilateral and bilateral retrospective studies. Since Indonesia lacked sufficient data on UDT male babies. The authors only observed their infertility patients at their fertility clinic. Additional study with a bigger sample size is required to describe the entire UDT population in Indonesia. Furthermore research is required to compare factors influencing paternity in men with a history of UDT.

Conclusion:

Men having a UDT history, especially with bilateral UDT, have more reduced fertility rates and higher hormonal and spermatogenesis disturbances than men without a history of UDT. Men with UDT have increased FSH and LH levels, lower rates of testosterone and estradiol compared with men without UDT. All men groups have mean prolactin and AMH levels within normal limits. Generally, men with UDT have poorer quality of semen as can be seen from below normal levels of sperm count, higher normal limits of sperm morphology, lower sperm viability, lower ejaculatory volume, and above normal levels of sperm immotility. Lastly, men with UDT have significantly more hypogonadal symptoms including low libido, low morning erections, and thinner body than men without UDT. This study suggests that men with a history of UDT undergo sperm analysis to detect infertility early. Early detection efforts assist men with a history of UDT in receiving treatment that can increase the likelihood of paternity.

Consent to Publish

Not applicable

Availability of Data and Materials

All data generated or analyzed during this study are included in the submission. The raw data can be requested from the corresponding author.

Competing Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Authors' Contribution

Conceptualization	:	PY, SW
Data curation	:	PY, SW
Investigation	:	PY, SW, AD, LF
Methodology	:	PY, SW, AD, RJL
Project administration	:	SW, AD
Supervision	:	PY, SW, AD, RJL
Visualization	:	PY
Writing – original draft	:	PY, SW, AD, MDR, LF
Writing – review & editing	:	PY, SW, AD, MDR, LF

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