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Age at diagnosis of undescended testis and associated factors in pediatric patients in a tertiary hospital

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Abstract

Background Undescended testis (UDT) is the most common congenital anomaly of the urogenital system in boys and is associated with long-term risks, including infertility in bilateral cases of UDT and testicular malignancy if not corrected promptly. International guidelines recommend referral by 6 months and surgical correction before 18 months of age. However, delays in diagnosis and management remain frequent worldwide. This study aimed to determine the age at diagnosis of UDT and to identify sociodemographic and perinatal factors associated with delayed diagnosis in a tertiary pediatric hospital in Iran.

Methods In this cross-sectional study, 70 patients with UDT who presented to the tertiary Children's hospital in one year were enrolled. Data were collected using a structured questionnaire completed by mothers, covering demographic, perinatal, and maternal variables. Statistical analyses were performed using SPSS software.

Results The median age at diagnosis of UDT was 29 months, with nearly half of the cases identified at birth or during the neonatal period. Despite early recognition in many patients, a significant proportion were diagnosed later than recommended. Among the studied variables, higher maternal age was significantly associated with delayed diagnosis, whereas maternal education, birth order, prematurity, and place of residence showed no significant correlation.

Conclusion Although many children with UDT in our study were diagnosed early, delays beyond the recommended age for intervention remain common. Maternal age emerged as a significant predictor of delayed diagnosis, underscoring the need for targeted parental education and systematic screening during infancy.

Keywords Cryptorchidism, Children, Testicular, Delayed diagnosis, Orchiopexy, Maternal factors

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Introduction

Undescended testis (UDT), also known as cryptorchidism, is among the most common congenital anomalies of the male genitalia, caused by the incomplete descent of the testes into the scrotum. An undescended testis may be located intra-abdominally, within the inguinal canal, or at the external inguinal ring [1, 2]. The condition affects 2–8% of full-term neonates and 33–45% of preterm or underweight infants, with more than 70% descending spontaneously during the first year of life. Consequently, the prevalence falls to about 1–2% at one year of age [3, 4]. However, persistent UDT beyond 3 to 6 months requires clinical evaluation and often surgical intervention [3].

The exact etiology of UDT is mainly unknown, but it is believed to involve a combination of genetic, hormonal, and neurochemical factors, as well as early birth, pregnancy in older women, and environmental factors. Reported risk factors include prematurity, intrauterine growth restriction, low birth weight, cesarean section delivery, and birth order (particularly first or second-born boys) [5–7].

Early diagnosis and intervention of UDT are important, as delayed treatment is associated with significant complications, including impaired spermatogenic potential, increased risk of testicular malignancy, testicular torsion, and psychological consequences [3, 8–10]. Among these, impaired fertility is the most significant concern, since proper testicular descent into the scrotum, where the lower temperature is essential for normal spermatogenic function, is critical for preserving reproductive potential [5, 11]. Men with a history of cryptorchidism have been shown to have up to a 10% lower fertility rate compared with those with normally descended testes [12, 13]. These risks highlight the importance of recommending surgical correction at an early age. Current guidelines generally recommend that undescended testes that do not descend by 6 months of age should be referred to a specialist, and orchiopexy is ideally performed between 6 and 18 months of age, with many experts advocating for correction by 12 months [14].

Despite these recommendations, studies indicate that many children are diagnosed or treated later than is optimal. Two large retrospective reviews were performed on UDT cases in the United States, and the median age at surgery was reported to be 1.6 years in one study and 4–5 years in the second one, with a majority of boys undergoing orchiopexy after two years of age [15, 16]. Similarly, a study conducted in Iran in 2011 reported that many children underwent delayed surgery, beyond 18 months of age. Reasons for delayed diagnosis or treatment include low awareness among parents, missed or delayed referrals, insufficient physical examination in early infancy, and health system or socioeconomic barriers [17]. However, more recent data regarding the age of diagnosis and orchiopexy in Iran are lacking. Particularly, in Iran, the initial assessment of a UDT typically occurs during neonatal and early infant examinations, which are conducted by pediatricians or general practitioners either at hospital discharge or during routine well-child visits. These visits are part of the national child health surveillance program. However, adherence to these follow-up visits and the thoroughness of genital examinations may vary between healthcare providers. Moreover, differences in parental awareness, documentation, and referral practices can contribute to variations in the timing of diagnosis and management. Such inconsistencies in primary evaluation and follow-up represent an important confounding factor when interpreting age at diagnosis in referral-based studies.

Understanding the age at diagnosis of UDT and the factors that contribute to delays is essential in improving outcomes. Early detection and timely surgery may preserve testicular function and reduce long-term morbidity. Therefore, this study aimed to assess the age at diagnosis of UDT among children referred for surgical correction in a tertiary pediatric hospital, and to identify the perinatal and socio-demographic factors associated with delayed diagnosis. Insights from this study may guide strategies to promote earlier referral, reduce risks, and optimize outcomes for affected children.

Methods

This study was designed as a descriptive cross-sectional study to evaluate the age at diagnosis of UDT and associated factors with delayed diagnosis among children referred for surgical management.

Population and data collection

The study was conducted over one year at a tertiary pediatric hospital. A total of 70 patients diagnosed with UDT who were referred for orchiopexy were included. All children with a confirmed diagnosis of UDT and scheduled for surgical intervention during the study period were eligible. Children with retractile or ascending testes, incomplete records, or missing key data were excluded. Only patients with true congenital UDT, whether unilateral or bilateral, were included.

Data were collected using a structured questionnaire administered to the mothers of the patients in the operating room before surgery. The questionnaire included demographic and perinatal information, including the child's age, age at UDT diagnosis, mother's age, maternal education level, place of residence, and birth order. In accordance with international recommendations (AUA), referral for an undescended testis should occur by 6 months of age [18]. Therefore, for this study,

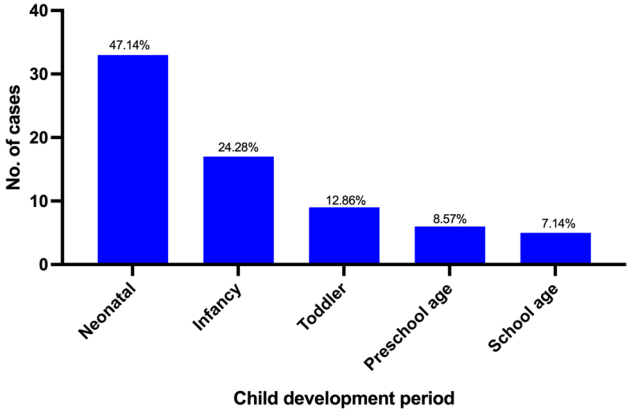

Fig. 1 The frequency of children diagnosed with undescended testes at different developmental stages: neonatal (0–28 days), infancy (29 days–12 months), toddler (13–36 months), preschool (37–72 months), and school age (> 72 months). The percentage is shown at the top of each bar

late diagnosis was defined as any diagnosis made after 6 months of age.

For analysis, age at diagnosis was categorized into clinically meaningful developmental intervals consistent with pediatric growth stages. The neonatal period included children aged 0–28 days. The infancy group included patients aged 29 days to 12 months. The toddler group included children aged 13 to 36 months. Preschool age included patients aged 37 to 72 months, and school age included those aged > 72 months. Patients were assigned to age groups based on their exact age at diagnosis.

Data analysis

All collected data were entered into SPSS software (version 29, IBM Corp., Armonk, NY, USA) for analysis. Descriptive statistics (frequencies and percentages) were calculated to summarize demographic and clinical characteristics. Associations between potential risk factors and age at UDT diagnosis were assessed using appropriate inferential tests: Student's *t* test, one-way ANOVA, or Pearson, where applicable. A significance level of $P < 0.05$ was considered statistically significant.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Review Board of Tehran University of Medical Sciences (ethical code: IR.TUMS.CHMC.REC.1398.104). Written informed consent was obtained from the parents of all participating children before enrollment, and confidentiality of patient information was strictly maintained.

Results

Age distribution of participants

A total of 70 patients with UDT were included in this study. Figure 1 illustrates the distribution of patients diagnosed with UDT across different ages. The median age at diagnosis was 29 months, ranging from birth to 166 months. Nearly half of the patients (47.14%, $n = 33$) were diagnosed at birth or during the neonatal period, while an additional 24.28% ($n = 17$) were diagnosed within infancy, and 12.86% ($n = 9$) during the toddler period. The proportion of diagnoses at later ages was markedly lower: preschool age (8.57%, $n = 6$) and school age (7.14%, $n = 5$).

Table 1 Factors associated with undescended testes patients and their correlation with age

Variables	Categories	Frequencies	Percentages	*P*-value
Mother's age (Years)	20–25	22	31.42	< 0.01
	26–30	28	40	
	31–35	11	15.71	
	36–40	6	8.57	
	> 40	3	4.28	
Mother's education level	Elementary and middle school	26	37.1	0.439
	High school	37	52.9	
	Graduate or post-graduate education	7	10	
Child rank	First	27	38.6	0.085
	Second	33	47.1	
	Third	10	14.3	
Maturity at birth	Preterm	55	78.57	0.913
	Term	15	21.43	
Residence area	Urban	66	94.28	0.703
	Rural	4	5.71	

Note: *P* values show the correlation between the distribution of age and other factors

Associated factors

Different factors associated with patients were assessed and reported in Table 1. Among the 70 children with undescended testis, the majority of mothers were between 26 and 30 years of age (40.0%, $n = 28$), followed by 20–25 years (31.4%, $n = 22$). Smaller proportions were observed in the 31–35 years group (15.7%, $n = 11$), 36–40 years group (8.6%, $n = 6$), and those older than 40 years (4.3%, $n = 3$). Among the 70 children with undescended testis, most mothers had completed high school education (52.9%, $n = 37$), followed by elementary or middle school education (37.1%, $n = 26$), and graduate or post-graduate education (10.0%, $n = 7$). Regarding birth order, 38.6% ($n = 27$) of affected children were first-born, 47.1% ($n = 33$) were second-born, and 14.3% ($n = 10$) were third-born. A large majority of patients were born preterm (78.6%, $n = 55$), while only 21.4% ($n = 15$) were born at term. The vast majority resided in urban areas (94.3%, $n = 66$), with only a small proportion of rural regions (5.7%, $n = 4$). Comorbid conditions were reported in

14.3% ($n = 10$) of patients, whereas 85.7% ($n = 60$) had no associated comorbidities.

The correlation of different factors with the age of diagnosis was evaluated (Table 1). Pearson's correlation analysis demonstrated a statistically significant association between maternal age and the child's age at UDT diagnosis ($r^2 = 0.22$, $P < 0.01$). This indicates a moderate positive correlation, suggesting that children of older mothers were diagnosed with UDT at a later age, although there is no strong linear trend. However, there was no significant correlation between age and other factors, including mother's education level, child rank, maturity at birth, and residence area ($P > 0.05$).

Discussion

In this study, we evaluated the age at diagnosis of UDT and associated factors among children referred for surgical management in a tertiary pediatric hospital. The median age at diagnosis was 29 months, with nearly half of the cases identified at birth or during the neonatal period. Despite early detection in many patients, a considerable proportion of children were diagnosed beyond the optimal age for intervention recommended by current guidelines. Importantly, we found that higher maternal age was significantly associated with delayed diagnosis of UDT, while other sociodemographic and perinatal factors, such as maternal education, birth order, prematurity, and place of residence, did not demonstrate a significant correlation.

Our findings align with previous studies that emphasize the frequent delay in UDT diagnosis and surgical correction. International guidelines recommend referral by 6 months of age and orchiopexy ideally between 6 and 18 months, with many experts advocating intervention before 12 months to optimize fertility potential and reduce long-term risks [18–20]. Nevertheless, evidence from different countries demonstrates that many children undergo orchiopexy beyond this period. Another study in Iran in 2011 reported that most children were operated on after 18 months of age [17], consistent with our observation that a subset of patients was diagnosed late.

Delays have also been reported internationally. Retrospective analyses from the United States show a median age at surgery between 4 and 5 years [15, 16], and Snodgrass et al. found the mean age at referral to be 43.3 months among 118 children [21]. In Saudi Arabia, Neel examined 345 boys with UDT and similarly noted late diagnosis [22]. Kurkcuoglu et al. in Turkey, in a cross-sectional study of 133 children, reported a mean diagnostic age of 37.5 months, ranging from birth to 156 months [23]. In Africa, Gasana and Mteta observed that over 80% of children were diagnosed after 5 years of age [24]. By contrast, Kohva and colleagues in Finland, studying 550 patients with disorders of sex development, reported a mean age at UDT diagnosis of just 1.1 years [25], suggesting that early detection is achievable in health systems with structured referral pathways. These disparities illustrate how local healthcare infrastructure, referral systems, and parental awareness play a central role in the timing of diagnosis.

Previous research has identified several predictors of UDT, including prematurity, a paternal history of UDT, and scrotal asymmetry on physical examination [26]. In contrast, our study identified maternal age as the only significant factor influencing the timing of diagnosis. Older maternal age has been previously linked to an increased risk of congenital anomalies, including UDT, possibly due to hormonal or placental insufficiency, but its relationship with the timing of diagnosis has not been widely documented [27]. It is plausible that delayed diagnosis in children of older mothers may reflect differences in health-seeking behavior, prioritization of medical care, or underlying biological mechanisms. Further large-scale studies are needed to clarify this association.

Interestingly, other factors commonly associated with UDT, such as prematurity and low birth weight [28], were not significantly correlated with age at diagnosis in our study. This may be due to the high prevalence of prematurity in our study population (78.6%), which limited variability and statistical discrimination. Similarly, maternal education and place of residence, factors often implicated in delayed healthcare access, did not emerge as significant predictors, possibly due to the tertiary referral setting of our study, where most patients are already filtered through the healthcare system.

Health system–related factors may also influence the timing of diagnosis. Variability in access to primary care, differences in the availability and adherence to scheduled well-child visits, and inconsistencies in genital examination practices among healthcare providers can all contribute to delays independent of parental or sociodemographic factors. It is important to note that the underlying causes of delayed diagnosis and intervention vary considerably across healthcare settings. In high-income countries, delays are primarily related to systemic factors such as missed or late referrals, fragmented communication between primary care and specialists, and prolonged surgical waiting lists despite timely initial detection. In contrast, in low- and middle-income countries, delays more commonly stem from limited parental awareness, late presentation, inconsistent adherence to well-child visits, and reduced access to pediatric urologic services. These differences highlight the need for context-specific strategies to improve early identification and timely orchiopexy.

This study has some limitations. The cross-sectional design precludes causal inference, and the single-center setting may limit generalizability. Moreover, reliance on

maternal reports for certain perinatal data introduces the possibility of recall bias. In addition, clinical characteristics such as unilateral versus bilateral involvement, testis palpability, and detailed neonatal parameters (e.g., birth weight, NICU admission) were not fully analyzed, which may represent additional confounders. Moreover, the questionnaire did not assess the interval between the initial diagnosis by a physician and the referral to a specialist, which may represent an additional source of delay that could not be evaluated in this study. Further, although sociodemographic characteristics were evaluated, several relevant variables, including family income, paternal education and occupation, and family size, were not consistently available in the medical records and therefore could not be analyzed. The absence of these factors may limit the depth of our assessment of social determinants influencing delayed diagnosis. The relatively small sample size and single-center referral design limit the generalizability of our findings and may introduce referral bias. Furthermore, the restricted set of available sociodemographic variables reduces the ability to draw strong conclusions regarding social determinants of delayed diagnosis. Larger, multicenter studies with more comprehensive data collection are needed to validate and expand upon these observations. Despite these limitations, the study provides valuable insights into the current state of UDT diagnosis in Iran, highlighting maternal age as a potential predictor of delay and emphasizing the persistent gap between guideline recommendations and clinical practice.

Conclusion

Our findings confirm that the delayed diagnosis of UDT remains a concern, with a subset of patients identified well beyond the recommended age for intervention. The significant association with maternal age suggests a potential target for future preventive strategies. Interventions to enhance early detection, including improved parental education, consistent neonatal examinations, and timely specialist referral, are essential to optimize outcomes, reduce risks, and preserve fertility potential in affected children.

Informed consent

Our patients were under 16 years of age, and all parents or guardians were informed and signed an informed consent form before the study.

Transparency statement

The corresponding author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned. All authors have reviewed and approved the final manuscript.

Authors' contributions

This study was led by Mastaneh Moghtaderi. All authors contributed to the analysis, manuscript drafting, and final revisions. All authors have read and approved the final version of the manuscript. Mastaneh Moghtaderi had full access to all of the data in this study and takes complete responsibility for the integrity and accuracy of the data and analysis. All authors have read and approved the final version of the manuscript.

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Data availability

The data supporting the findings of this study are available on request from the corresponding author. The datasets created during this study are not publicly accessible due to the possibility of compromising the privacy of individuals.

Declarations

Ethics approval and consent to participate

The method was approved in accordance with the scientific and moral standards of our university, and all procedures were performed in accordance with the Declaration of Helsinki guidelines and regulations. This study was reviewed by the Ethics Committee of Tehran University of Medical Sciences, and all data were collected after obtaining the appropriate permissions and a batch number (IR.TUMS.CHMC.REC.1398.104). STROBE reporting guidelines for observational research were used and adhered to throughout the study.

Competing interests

The authors declare no competing interests.

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