

# Undescended Testes: Incidence in 1,204 Consecutive Male Infants and Outcome at One Year of Age

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**Background:** Undescended testes (UDT) are a common congenital abnormality occurring in 2–5% of full-term boys at birth in the Western countries. By one year of age, the incidence rate spontaneously reduces to 1–2% in this group. Men with a history of UDT are at a higher risk of testicular cancer. Impaired fertility is another long-term risk associated with UDT. Although our knowledge on cryptorchidism has increased considerably over the last decades, many questions remain to be answered: Is the incidence rate increasing? What are the causes of undescended?

**Materials and methods:** It was a hospital-based study. Totally, 1204 consecutively born boys were examined for cryptorchidism at birth and, if present, again at one year of age. The effect of birth weight, gestational age, the presence of other sexual abnormality in an individual, maternal history of gestation abnormalities, the mode of delivery and complications, parental constitutional and professional factors regarding cryptorchidism were documented.

**Results:** In a study of 1,204 consecutive newborns, 69 (5.7%) were found to have undescended testes (UDT): undescended was monolateral in 3.07% and bilateral in 2.66%. The rate and laterality of the UDT were associated with lower birth weight ( $p < 0.001$ ) and prematurity ( $p < 0.001$ ). Boys with UDT were also more likely to have other congenital abnormalities of the external genitalia, the commonest being scrotal hypoplasia. No correlation between UDT and maternal age, birth order, mode of delivery was demonstrated in this study, but paternal BMI  $< 20 \text{ kg/m}^2$  was a significant risk factor (OR = 5.46). Although 52/69 (75%) of UDT infants achieved full spontaneous descent by one year of age, 1.4% of them remained with undescended testes (1.2% monolateral and 0.2% bilateral). Premature infants with UDT were more likely to achieve full testicular descent at 1 year of age than term infants with UDT (RR = 0.63). On the contrary, poor gain in height and weight during the first year of life interfered spontaneous descent of testes (RR = 3.23 and RR = 4.9, respectively)

**Conclusions:** The rates of cryptorchidism were 5.7% at birth and 1.4% at 1 year of age. The most common risk factors were prematurity, low birth weight, abnormal pregnancy and a decreased paternal BMI. Spontaneous descent of testes during the 1st year was more frequent in case of bilateral monolateral undescended than. The history of abnormal pregnancy and a good height or weight gain facilitated this process.

**Key words:** cryptorchidism, prematurity, birth weight and height, spontaneous descent

## INTRODUCTION

Undescended testes (UDT) are a common finding during routine postnatal examination of the new-

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born. In a study in the late 1950s of over 3,000 male infants delivered in West London and followed up to 1 year of age, Scorer (1) reported an overall incidence of UDT of 2.7% at birth and 0.8% at 3 months. Subsequent reports over the years have indicated variability in the incidence. The need of orhidopexies in recent years has increased, indicating an increasing frequency in UDT (2). This observation was supported by recent studies show-

ing an incidence of 5.1% of UDT at birth, with a higher incidence in premature and low birth weight (LBW) infants (3).

The etiology of the disorder is not known, but normal hypothalamo-pituitary-gonadal axis is usually an indispensable condition for normal descent of the testes (4). Abnormal sexual differentiation is associated with undescend. However, the majority of boys with UDT show no endocrine abnormalities after birth.

The consequences of UDT include tumor development, infertility or subfertility in adulthood, associated hernias, torsion of cryptorchid testes, and the psychological effects of an empty scrotum (4). Some 10% of patients with testicular cancer have a history of UDT (5, 6); this is thus an important congenital defect. The fertility potential may be improved by early treatment.

Increased degeneration of germ cells can be observed in UDT after the first year, and therefore early treatment is recommended. Surgical treatment is the most effective and reliable method to bring testes into the scrotum, but hormone treatment with HCG can be considered, particularly in cases where testes can be palpated in high scrotal position.

## OBJECTIVE

It was the aim of this study to determine the incidence of UDT and subsequent descent of UDT until the 1st year of age in a group of consecutive male infants delivered in Panevėžys Hospital.

## MATERIALS AND METHODS

A total of 1,204 consecutive male newborns delivered in Panevėžys Hospital were examined for UDT by the first author at 24 to 48 h of life in the postnatal wards as part of the routine postnatal examination. Data on perinatal history, birth order, birth weight and gestational age, parental medical, constitutional and professional factors were recorded for further analysis.

The terms "cryptorchidism" and "UDT" are used synonymously in this study. Several classifications have been devised for categorizing the cryptorchid testis (7). In this study, the classification adopted was "undescended testis by the position," *i.e.* the location of the testis on physical examination (8). The position in the scrotum was determined after manipulation of the testis into the lowest position along the pathway of the normal anatomical descent without tension being applied. The position of each testis was classified as normal (well down in the scrotum) or undescended: prescrotal, inguinal and nonpalpable testes.

A premature infant was defined as an infant born before 37 completed weeks of gestation. Gestational age was assessed by maternal dates, antenatal ultrasonographic examination and Dubowitz score postnatally (Dubowitz et al., 1970). Abnormal pregnancy was defined in the cases of threatened spontaneous abortion, gestational toxicosis, fetal hypoxia and multiple gestation or combination of them. An LBW infant was defined as an infant weighing less than 2500 g. Infants were defined as small for gestational age (SGA) if the birth weight in grams was less than 10th percentile according to their gestational age at birth. Newborns cryptorchid at birth were re-examined for undescended testes at 1 year of age. They were measured for body weight and in supine position for body length also.

The STATISTICA 5.5 and Excel 2000 software packets were used for statistical analysis of the data. It was performed using Goodness-of-fit Pearson Chi-square ( $\chi^2$ ) method for testing the joint significance of differences in proportions in multiple two-by-two tables. The significance of risk factors for cryptorchidism was tested by logistic regression and expressed by odds ratio (OR) and relative risk (RR). The p values of <0.05 were deemed significant.

## RESULTS

Between 13 October 1996 and 30 November 1997, there were 1226 male livebirths. Newborn screening for cryptorchidism was performed in 1204 (98%) boys. Of all examined newborns, 1135 (94.3%) had fully descended testes while 69 (5.7%) had one or both testes undescended by laterality: monolateral cryptorchidism was detected in 37 (3.07%) and bilateral in 32 (2.66%). Totally, 101 UDT were detected classified by position: 71 (69.3%) were presc-

Table 1. Relationship between birth weight and incidence of undescended testes (UDT)

Birth weight (g)	Number of infants examined at birth	Number of infants with UDT at birth	(%) <sup>a</sup>
< 1500	4	2	50.0
1500–1999	14	4	28.6
2000–2499	51	11	21.6
2500–2999	132	14	10.6
3000–3499	380	13	3.4
3500–3999	454	17	3.7
4000–4499	130	7	5.4
≥ 4500	39	1	2.6
Total	1204	69	5.7

<sup>a</sup> $\chi^2 = 54.5$ ;  $p < 0.0001$ .

**Table 2. Relationship between maturity at birth and incidence of undescended testes (UDT)**

Maturity (weeks)	Number of infants examined at birth	Number of infants with UDT at birth	(%) <sup>a</sup>
< 37	94	17	18.1
37	61	6	9.8
38	105	3	2.9
39	191	10	5.2
40	560	25	4.5
> 41	193	8	4.1

<sup>a</sup> $\chi^2 = 28.8$ ;  $p < 0.0001$ .**Table 3. Relationship between birth weight according to gestational age and incidence of undescended testes (UDT)**

Birth weight according to gestational age	Number of infants examined at birth	Number of infants with UDT at birth	(%) <sup>a</sup>
Infants normal for gestational age	1099	57	5.2
Infants small for gestational age	105	12	11.4
Total	1204	69	5.7

<sup>a</sup> $\chi^2 = 6.99$ ;  $p < 0.05$ .

rotal, 11 (12.9%) canalicular and 19 (17.8%) unpalpable testes.

Cryptorchidism incidence was associated ( $p < 0.0001$ ) with birth weight: the less birth weight, the more frequent cryptorchidism rate (Table 1).

Preterm infants were also found to have a significantly higher incidence of cryptorchidism (Table 2).

The incidence of cryptorchidism at birth was significantly higher in SGA infants as compared to infants normal for gestational age (Table 3).

The incidence of bilateral UDT (70.6%) was significantly higher than monolateral cryptorchidism (29.4%) in newborns with the birth weight less than 2500 g. Concurrently, bilateral cryptorchidism was not significantly more frequent than monolateral in premature infants (Table 4).

Of the 69 newborns with cryptorchidism, 15 (21.7%) had associated abnormalities of genitalia: scrotal hypo-

**Table 4. Relationship between laterality of undescended testes and infant's birth weight and gestation**

Birth weight according to gestational age	Bilateral (n = 32) examined at birth	Unilateral (n = 37) with UDT at birth	p values
Birth weight (g):			
< 2500 (n = 69)	12 (70.6%)	5 (29.4%)	< 0.05
≥ 2500 (n = 1135)	20 (38.5%)	32 (61.5%)	< 0.05
Gestation (weeks)			
< 37 (n = 94)	10 (58.8%)	7 (41.2%)	> 0.05
≥ 37 (n = 1110)	22 (42.3%)	30 (57.7%)	> 0.05

**Table 5. Distribution of associated abnormalities of genitalia in infants with undescended testes (UDT)**

Associated abnormalities	Infants with UDT and associated abnormalities		Infants with descended testes and associated abnormalities	
	(n = 69)	(%)	(n = 1135)	(%)
Scrotal hypoplasia	6	(8.7)	0	–
Hypospadias	1	(1.4)	4	(0.4)
Micropenis	2	(2.9)	20	(1.8)
Hydrocele	5	(7.2)	51	(4.5)
Hernia	1	(1.4)	1	(0.1)
Total	15	(21.7) <sup>a</sup>	76	(6.7) <sup>a</sup>

<sup>a</sup> $\chi^2 = 10.8$ ;  $p < 0.01$ .

plasia, hypospadias, micropenis, hydrocele, inguinal hernia ( $p < 0.01$ ) (Table 5). The most common was scrotal symmetric or unsymmetric hypoplasia (8.7%).

The incidence of UDT was found to be related to abnormal pregnancy and a decreased paternal

**Table 6. Cryptorchidism risk due to abnormal pregnancy and decreased paternal body mass index (BMI)**

Factors	Cryptorchidism group	Boys with descended testes	OR	95% CI
	n (%)	n (%)		
Normal pregnancy	36 (52.2)	794 (70.0)	0.47*	0.44–0.50
Abnormal pregnancy	33 (47.8)	341 (30.0)	2.13*	1.93–2.36
Paternal BMI (kg/m <sup>2</sup> ):				
< 20	5 (7.3)	16 (1.4)	5.46*	3.56–8.38
20–25	39 (56.5)	751 (66.2)	0.66*	0.62–0.71
25–30	23 (33.3)	317 (27.9)	1.29	1.16–1.43
> 30	2 (2.9)	51 (4.5)	0.63	0.48–0.83

OR, odds ratio; 95% CI, 95% confidence interval; \* $p < 0.05$ .

body mass index (BMI) (Table 6). The mode of delivery, birth order and other parental constitutional (age, height, weight, maternal BMI) and professional factors were insignificant for cryptorchidism.

When re-examined at 1 year of age, overall 51 (75%) from 68 surviving children with UDT at birth achieved full testicular descent. Both LBW and preterm infants achieved testicular descent in 81.2% of (RR = 0.63). Normal birth weight infants and term born boys experienced testicular descent in 73.1% (RR = 1.6). The difference was insignificant in the comparable groups. Interestingly, infants from abnormal pregnancies showed more frequent testicular descent compared to boys from normal pregnancy. A boy from abnormal pregnancy with UDT had a lower RR (0.37) of not achieving testicular descent at 1 year of age compared to an infant from normal pregnancy with UDT (Table 7).

If infants with UDT demonstrated poor height and weight gain during the 1st year of life, they had a higher RR (3.2 and 4.9, respectively) of not achieving full testicular descent at 1 year of age (Table 8).

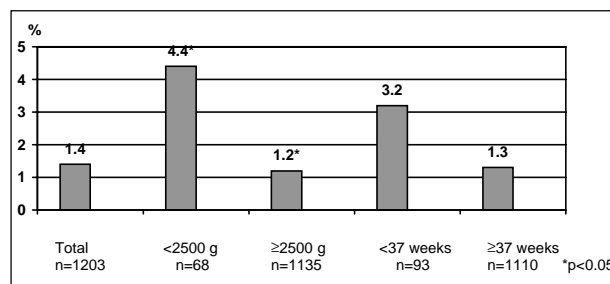


Figure. Relationship between cryptorchidism rate at 1 year of age and birth weight (g) or gestation (<37 weeks, preterm-born infants; ≥37 weeks, term-born infants)

The overall rate of UDT during the 1st year of life decreased from 5.7% at birth to 1.4% at 1 year of age: 14 (1.2%) infants had unilateral UDT and only 3 (0.2%) bilateral. Cryptorchidism rate was less in infants of 1 year of age if their birth body weight was more than 2500 g compared to infants whose birth weight was less than 2500 g. We did not detect significant higher cryptorchidism rate in preterm infants compared to term-born (Figure).

Table 7. Testicular descent rate in 68 infants with undescended testes detected at birth

Factors	Testicular descent before 1 year		Undescended testes at 1 year		RR; (95% CI)
	n	(%)	n	(%)	
Birth weight < 2500 g	13	(81.2)	3	(18.8)	0.63; (0.48–0.82)
Birth weight ≥ 2500 g	38	(73.1)	14	(26.9)	1.6; (1.21–2.1)
Premature infants	13	(81.3)	3	(18.8)	0.63; (0.48–0.82)
Term infants	38	(73.1)	14	(26.9)	1.6; (1.21–2.1)
Abnormal pregnancy	27	(84.4)	5	(15.6)	0.37; (0.28–0.49)*
Normal pregnancy	24	(66.7)	12	(33.3)	2.7; (2.05–3.55)*

RR, relative risk; 95% CI, 95% confidence interval; \*p < 0.05.

Table 8. Testicular descent rate in 68 infants with undescended testes in association with height or weight gain

Factors	Testicular descent in 1 year		Undescended testes at 1 year		RR; (95% CI)*
	n	(%)	n	(%)	
Height < 10 percentile	11	(57.9)	8	(42.1)	3.23; (2.46–4.25)
Height ≥10 percentile	40	(81.6)	9	(18.4)	0.31; (0.24–0.41)
Weight < 10 percentile	4	(44.4)	5	(55.6)	4.90; (3.72–6.44)
Weight ≥10 percentile	47	(79.7)	12	(20.3)	0.20; (0.16–0.27)

RR, relative risk; 95% CI, 95% confidence interval; \*p < 0.05.

## DISCUSSION

This prospective study showed that 5.7% of male infants born in Panevėžys had UDT on the 2nd day of life. This figure is comparable with those of studies conducted elsewhere, e.g., 5.1% in Oxford, United Kingdom (3) and 4.1% reported by Buemann et al. (4) in Denmark. There is also a higher rate of UDT in neonates with LBW, including infants born small for gestational age: 11.4% in SGA infants compared to 5.2% in infants born normal weight for gestational age. A similar observation was also made in neonates with a low gestational age.

The difference in the incidence of UDT in term and preterm infants can be explained by the embryology of the descent of testes. The process takes place in two separate stages. The first consists of testicular descent (transabdominal descent) in which the testes move from the urogenital ridge to the level of the internal inguinal ring. This process is thought to be due to the differential somatic growth of the developing fetus and may be androgen-independent (4). The testes remain there un-

til the 28th week of gestation, when they begin their descent into the scrotum. In the second, or inguinoscrotal stage, the testes normally complete their descent by 35–40 weeks of gestation. The second stage is believed to be controlled by testosterone, dihydrotestosterone and other hormones that regulate gubernaculum differentiation and regression. In addition, the processus vaginalis is also involved as the testes migrate into the scrotum (10).

Interruption of testicular descent at various levels, for example, by premature delivery or poor somatic growth, may therefore result in UDT. The results of this study also showed that bilateral UDT were more common in premature and especially in LBW neonates. This is consistent with the results of other studies (1, 11, 12). For a term infant, an unfavorable anatomical position may be the reason for poor testicular descent. It has been reported that these anomalies include an abnormal course of Scarpa's fascia, as well as abnormal epididymis and gubernacular attachment (10).

Abnormal pregnancy is associated with impaired placental metabolism and turnover between mother and fetus. Reduction in intrauterine somatic growth might be a consequence of such anomaly, as well as deficient human chorionic gonadotropin causes miscarriage or undescend of testes.

Risk factors for cryptorchidism may include maternal obesity, congenital malformations, disturbances of menstrual cycle, and firstborn and caesarian deliveries (12–14). In this prospective study, we did not find any correlation between undescended testes and parental constitutional factors, with exception of a decreased paternal BMI. Association between cryptorchidism and decreased paternal BMI could be explained by the action of testosterone, a potent anabolic agent, or various specific growth factors. Unfortunately, we do not know any publication dealing with this phenomenon (15, 16).

We did not find any correlation between UDT and birth order, mode of delivery, parental professional factors and maternal nicotine smoking (17). However, this study demonstrated a significant association between UDT and other congenital abnormalities of the genitalia (17–19). Both inguinal hernias and hydroceles occur as a consequence of incomplete closure of the processus vaginalis, what may be a reason of an impaired fixation of the gubernaculum to the scrotum. Another study reported that males with cryptorchidism were more likely to have hypospadias, a small scrotum and poor scrotal rugation than boys with normally descended testes at birth (3).

Abnormal histopathological changes and germ cell damage in UDT is well established by 24 months of age (20). Some authors that performed an ana-

tomic, morphologic and volumetric analysis of testicular maldescent reported that the unilateral UDT were significantly smaller and softer than the contralateral normal testis (14). In recent years, other authors have even recommended orchidopexy in the 1st year of life to preserve the fertility potential (16).

Of the 68 (17 preterm and 52 term) infants, 51 (75%) achieved complete testicular descent by the first year of age. This is comparable to other reported studies (1, 3). The 5.7% incidence of UDT at birth and a 75% descent rate at 1 year of life suggests that the incidence of cryptorchidism for the male infant cohort studied at 1 year of age is 1.4%. A higher rate in descent was seen in bilateral than in monolateral UDT. The possibility of overestimation of the true incidence of UDT is discussed, as Panevėžys Hospital may be a referral center for high-risk pregnancies and premature deliveries (21). The true incidence of UDT in the general population is unknown.

In the case of history of abnormal pregnancy, more frequent spontaneous descent of testes during the 1st year of life compared to infants from normal pregnancies is a phenomenon to be investigated in the future. It might be explained by some systemic humoral factors that take place when abnormal pregnancy is diagnosed, contrary to a local structural cause of cryptorchidism in cases of physiologic pregnancy.

Our study indicates that a normal birth weight and term infant from normal pregnancy with cryptorchidism has a higher relative risk of not attaining testicular descent. It is reassuring to parents that the majority of premature and LBW infants with UDT at birth, if they show good gain in weight and height, are likely to achieve full testicular descent by 1 year of life. For reasons alluded previously, it is important that long-term regular follow-up be emphasized to parents whose infants have UDT, and clinicians following these infants should ensure that hormonal or surgical correction be made preferably before the 2nd year of life (8, 20).

## CONCLUSIONS

We found the rate of cryptorchidism to be 5.7% at birth and 1.4% at 1 year of age, and it is comparable to the rates reported from Western countries. The most common risk factors were prematurity, low birth weight, history of abnormal pregnancy and decreased paternal body mass index. Bilateral undescended testes were prone to more frequent descent during the 1st year of life compared to monolateral cryptorchidism. Factors associated with the spontaneous descent during the 1st year of life we-

re history of abnormal pregnancy and good height or weight gain.

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### KRIPTORCHIZMAS: DAŖNUMAS TARP 1204 IŠ EILĖS GIMUSIŲ NAUJAGIMIŲ BERNIUKŲ IR PRAĖJUS VIENERIEMS METAMS

#### S a n t r a u k a

Ištyrus iš eilės gimusius 1204 naujagimius berniukus, nenusileidusios sėklidės nustatytos 69 (5,7%) berniukams. Kriptorchizmo, t. y. vienpusio ar abipusio sėklidžių nenusileidimo, dažnumas priklausė nuo mažesnio gimimo svorio ( $p < 0,001$ ) ir neišnešiojimo laipsnio ( $p < 0,001$ ). Berniukams, gimusiems su nenusileidusiomis sėklidėmis, dažniau pasitaikydavo ir kitų išorinių lyties organų anomalijų, tarp kurių dažniausia buvo kapšelio hipoplazija. Tyrimai nepatvirtino ryšio tarp kriptorchizmo dažnumo ir motinos amžiaus, nėštumo skaičiaus bei gimdymo būdo. Pirmais gyvenimo metais sėklidės savaime nusileido 52/69 (75%) berniukams todėl kriptorchizmo dažnumas sumažėjo iki 1,4%. Esant abipusiam kriptorchizmui, sėklidės nusileido dažniau. Savaime sėklidės dažniau nusileisdavo kūdikiams, gimusiems iš patologinio nėštumo, lyginant su gimusiais iš fiziologinio nėštumo. Jei per pirmus gyvenimo metus berniukų svoris ir ūgis padidėdavo nedaug, savaiminio sėklidžių nusileidimo tikimybė būdavo mažesnė.

**Raktažodžiai:** kriptorchizmas, neišnešiojimo laipsnis, gimimo svoris ir ūgis, savaiminis sėklidžių nusileidimas