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Prevalence and Impact of External Genitourinary Anomalies among Children undergoing routine Circumcision

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ABSTRACT

Background: The knowledge of the incidence of congenital anomalies is important for planning health services in our country. It helps in planning the budget as well as measures for the management and the prevention of the disorders. It also helps to establish a program raising awareness of urogenital anomalies and their management.
Aim of the study: The aim of this study is to evaluate the normal anthropometric value of the normal penis and to detect the prevalence and impact of external genitourinary anomalies among 3000 Egyptian children attending for nonmedical circumcision.
Patients and Methods: The prospective multi centric study was done on 3000 male babies coming for routine circumcision in an outpatient clinic at Al Azhar university hospitals in the period from 2018 to 2021. All babies were examined and evaluated for the genitourinary parameters.
Results: the study suggests normal anthropometric values of SPL , AGD, preputial length, meatal diameter according to age. The incidence of urogenital anomalies among studied children is about 18.4%.
Conclusion: This study gives value reference and percentile curves for stretched penile length (SPL) , AGD, Preputial length, meatal diameter and glans closure length in healthy Egyptian males from the age of one day to 10 years

Keywords: *stretched penile length (SPL); anogenital distance AGD; Preputial length; meatal diameter; urogenital anomalies.*

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INTRODUCTION

Anomalies of the male external genitalia and groins are a set of lesions not easily understood by many kids and their parents. This is particularly so where the parents may not be certain of what a normal external genitalia and groin should look like, or out of sheer negligence. The absence of any immediate functional derangement usually reinforces such indifference to the presence of the abnormalities. Late presentation may then be inevitable, which may be in form of life-threatening complications such as strangulated hernia or grave sequelae such as infertility. The optimal time for the treatment of most of these surgically correctable lesions is infancy and childhood.[1]

Congenital anomalies of the kidney and urogenital system range from mild, asymptomatic malformations to severe, life threatening pathologies (like bilateral renal agenesis or renal dysplasia) and complex ethical dilemmas like DSD**.** Many congenital abnormalities are part of a syndrome whose impact extends beyond the urogenital system. For example, there are some congenital urological abnormalities leading to oligohydramnios and, therefore, severe pulmonary problems. [2]

In Egypt, studies for age-related anthropometric value of the normal genital parameters are limited and there are no previous studies on preputial length in relation to age in children.

PATIENTS AND METHODS

Prospective multi-centric study was done on 3000 male babies coming for routine circumcision in an outpatient clinic in Al Azhar university hospitals in the period from 2018 to 2021 all babies were examined and evaluated for the genitourinary parameters and photos were taken after consent. Any cases with genitourinary anomalies were separated and investigated by hormonal assay.

Inclusion criteria

Infants or children who came for routine circumcision and the age: 1st day-10 years.

Exclusion criteria

Circumcised boys, preterm babies, chronic ill babies and low birth weight babies

Patient who has any surgical complaint other than circumcision

Syndromic patients

Penile length:

After a maximum stretch of the penis measurement was done from the symphysis pubis to the tip of the penis in mm by a digital caliper.

Prepuiteal length:

After marking the site of the corona and stretching the preputial skin measurement was taken from the marking sign to the tip of the prepuce by a digital caliper.

Anogenital distance:

AGD was measured from the anal verge to the posterior aspect of the scrotum by a digital caliper in the supine, frog-leg position while legs are abducted allowing the soles to touch each other.

Meatal size

The lubricated meatal calibrator was inserted into meatus till impaction and recorded on the mm scale this occurs under complete aseptic conditions.

Measurement of ventral glans closure was measured as the distance between the distal limit of urethral meatus to coronal sulcus on the ventral glans in mm by a digital caliper.

The dorsum of the glans was measured as the distance between the coronal sulcus and the proximal limit of urethral meatus in mm by a digital caliper.

RESULTS

This prospective study was done on 3000 male babies who came for routine circumcision. There were 30 babies who had a family history of urogenital anomalies and 552 babies had urogenital anomalies. The mean age was 2.53 ± 2.9 years.

Penile length is directly proportional to the age of the child and there is a rapid increase in SPL in the first few months of life this reflects the effects of mini-puberty. Penile length is ranging from 28.1 mm at the 5th percentile to 43.7 mm at the 95th percentile in the first year of life. Penile length is ranging from 43.0 mm at the 5th percentile to 64.7mm at the 95th percentile at the age of ten years (Table1, 2; Figure 1, 2).

Meatal opening diameter ranges from 2.3 mm at the 5th percentile to 4.3 mm at the 95th percentile in the first year of life and ranges from 3.9 mm at the 5th percentile to 6.1 mm at 95th percentile at the age of ten years (Table 3; Figure 3).

There is also an increase of AGD with age, especially at the first year of life. AGD Mean ± SD 37.6 ± 18.3 mm at the age of the first year and 74.6 ± 7.6 at the age of 10 years. Anogenital distance is ranging from 23.9mm in the 5th percentile to 52.4mm in the 95th percentile in the first year of life. AGD is ranging from 62.9mm in the 5th percentile to 87.2mm in the 95th percentile at the age of ten years (Table 4; Figure 4)..

There is a significant Strong correlation between glans closure line length and the length of dorsal glans, with a weak correlation between glans closure line length and meatal opening diameter (Table 5; Figure 5).

Galns closure length=0.069+.0.393× length of dorsal glans

Galns closure length=3.673+.0.391× meatal opening diameter

Slit shape of the meatus represents 99.0%, rounded shape represents 0.6%, fish mouth represents 0.3% and crescent shape represents 0.04% (Table 6).

Incidence of urogenital anomalies among studied children represents about 18.4%.

Microphallus represents about 1.13%, macrophallus 0.2 %, RT penile rotation 0.6%, Lt penile rotation 3.2%, penile curvatur1.3%, webbed and buried penis 1.3%, penile melanoma 0.2%, penoscrotal transposition 0.8%.

There is one case of the prepubic sinus was detected which represents about 0.03%.

Hypospadias represents about 1.9%, epispadias represents about 0.03%, megameatus represents about 0.9%, meatal stenosis represents about 0.5%, double meatus represents about 0.2%, parameatal urethral cyst represents about 0.06%.

Splitted median raphe represents about 0.5%, absent median raphe represents about 0.06%, deviation of median raphe represents about 3.2%, and prominent median raphe represents about 0.6%. Micropothia represents about 0.13%, and macropothia represents about 0.06%.

RT cryptorchidism represents about 1.3%, Lt cryptorchidism represents about 1.1% and retractile testis represents about 0.2%.

RT hydrocele represents about 5.5%, LT hydrocele represents about 5.3%, Scrotal hypoplasia represents about 0.4%, Lt inguinal hernia represents about 0.2% RT inguinal hernia represents about 0.13%, Scrotal melanoma represents about 0.13%, bifid scrotum represents about 0.06%.

There is a significant relationship between hypogonadism and microphallus and cryptorchidism Figure 7)..

Normal studied group		Total No. = 2448						
		Penile length percentiles						
Age (year)	No.	5 th	10 th	25 th	50 th	75 th	90 th	95 th
0	831	28.1	29.1	32.1	35.5	38.2	41.6	43.7
1	322	31.7	33.0	36.0	37.3	39.6	42.1	44.7
2	283	33.0	33.4	36.9	38.2	41.1	44.4	46.0
3	203	32.3	35.0	37.0	40.6	43.1	45.1	47.1
4	198	35.0	36.8	39.1	42.2	43.7	47.9	50.2
5	156	36.7	37.9	40.0	43.6	46.1	50.2	52.1
6	125	37.2	38.1	42.0	45.1	49.1	52.7	53.8
7	99	38.0	40.8	43.6	46.0	50.1	52.0	54.3
8	68	39.7	42.3	44.4	46.6	52.0	55.3	62.7
9	63	42.2	43.0	47.0	51.8	55.7	58.7	61.0
10	100	43.0	43.7	48.7	53.1	57.0	61.8	64.7

Table 1: Penile length percentiles by age among normal studied group by mm.

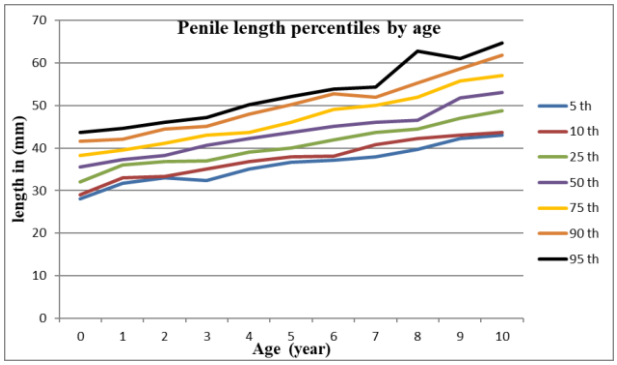

Fig 1: Penile length percentiles by age.

Normal studied group		Total No. = 2448						
		Prepuiteal length percentiles						
Age (year)	No.	5 th	10 th	25 th	50 th	75 th	90 th	95 th
0	831	15.1	16.0	17.0	19.7	22.0	24.0	25.5
1	322	16.1	17.0	18.9	20.1	22.6	25.0	26.0
2	283	17.0	18.1	19.1	21.1	23.1	24.8	26.2
3	203	17.2	18.1	19.7	22.7	23.4	26.3	27.1
4	198	17.6	18.1	21.0	23.1	25.0	27.0	27.1
5	156	18.4	19.4	21.2	23.1	25.9	28.0	30.2
6	125	18.5	20.2	22.6	25.0	26.0	28.3	30.5
7	99	18.9	20.0	22.8	24.1	26.6	29.1	32.2
8	68	21.0	21.9	23.0	24.5	27.0	30.2	33.1
9	63	21.9	21.8	23.1	26.4	27.2	31.6	33.9
10	100	22.3	23.1	25.1	26.7	29.1	32.7	35.0

Table 2: Prepuce length percentiles by age among normal studied group by mm.

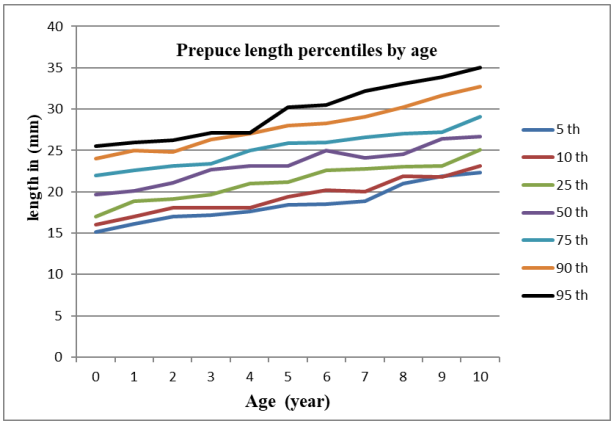

Fig 2: Prepuce length percentiles by age.

Normal studied group		Total No. = 2448 Meatal opening diameter percentiles						
Age (year)	No.	5 th	10 th	25 th	50 th	75 th	90 th	95 th
0	831	2.3	2.5	2.9	3.2	3.8	4.2	4.3
1	322	3.0	3.1	3.6	4.0	4.2	4.5	4.7
2	283	3.1	3.2	3.6	4.0	4.3	4.6	5.0
3	203	3.1	3.3	3.9	4.2	4.5	4.8	5.0
4	198	3.1	3.5	3.9	4.3	4.5	4.8	5.0
5	156	3.2	3.6	4.1	4.6	4.9	5.1	5.1
6	125	3.6	3.9	4.1	4.6	4.9	5.0	5.3
7	99	3.5	3.6	4.2	4.6	4.9	5.1	5.3
8	68	3.6	3.9	4.2	4.8	5.1	5.7	6.0
9	63	4.0	4.0	4.4	4.9	5.3	5.7	6.0
10	100	3.9	4.1	4.6	4.9	5.3	5.9	6.1

Table 3: Meatal opening diameter percentiles by age among normal studied group by mm.

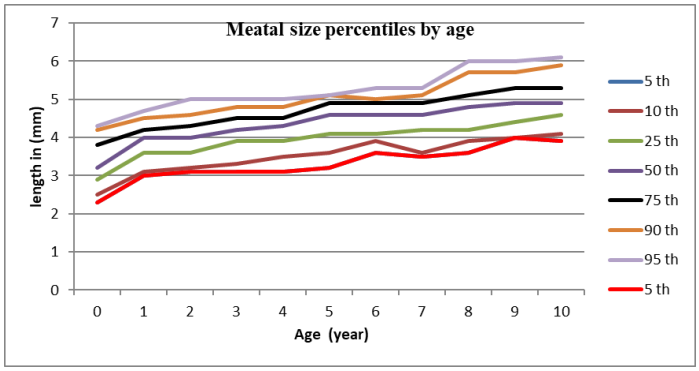

Fig 3: Meatal size percentiles by age.

Normal studied group		Total No. = 2448 Anogenital distance percentiles						
Age (year)	No.	5 th	10 th	25 th	50 th	75 th	90 th	95 th
0	831	23.9	26.5	31.0	36.1	42.5	48.6	52.4
1	322	35.0	37.8	42.7	47.0	52.7	55.9	58.1
2	283	36.0	40.0	44.7	50.0	56.1	63.0	66.0
3	203	35.5	41.0	45.2	51.4	57.6	66.0	68.9
4	198	37.8	43.0	46.6	53.8	62.1	68.1	71.0
5	156	42.9	46.0	53.0	57.3	63.3	73.1	76.1
6	125	44.5	48.1	55.4	62.3	68.0	75.1	76.7
7	99	47.8	49.7	56.0	66.0	71.0	77.0	84.1
8	68	48.0	56.3	66.0	73.0	77.0	83.9	85.1
9	63	57.1	59.3	67.3	73.0	80.1	85.7	86.0
10	100	62.9	63.7	68.3	75.9	80.0	85.6	87.2

Table 4: Anogenital distance percentiles by age among normal studied group by mm.

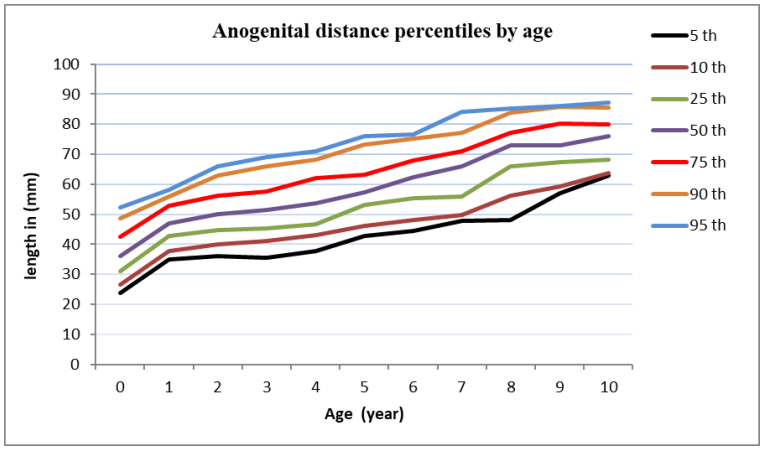

Fig 4: Anogenital distance percentiles by age.

Variables	Pearson correlation (r)	P- value
length of dorsal glans	0. 60	0.00 (1)
Meatal opening diameter	0. 25	1.0 (2)

Table 5*:* Correlation between glans closure line length with length of dorsal glans & Meatal opening diameter.

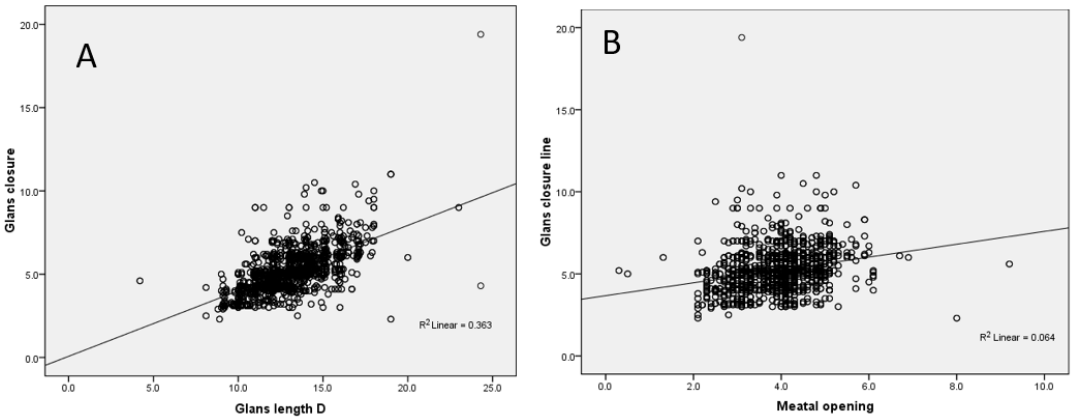

Fig 5: A. Linear regression between glans closure line length with length of dorsal glans. B. Linear regression between glans closure line length with meatal opening diameter.

Variables	Glans closure line length			
	R2	B	95.0% Confidence Interval for B	P- value
length of dorsal glans	0.36	0.393	0.372 - 0.414	0.00*
Meatal opening diameter	0.064	0.391	0.332- 0.451	0.00*

Table 6: Linear regression between glans closure line length with length of dorsal glans & Meatal opening diameter.

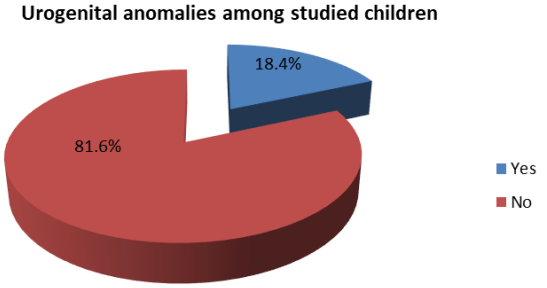

Fig 7: Incidence of urogenital anomalies among studied children.

DISCUSSION

This study gives value reference and percentile curves for stretched penile length (SPL) and AGD in healthy Egyptian males from the age of one day to 10 years. Stretched penile length increased gradually from a mean+ SD of 3.55+ 0.51cm in the first year of life to 44.0 ± 4.9 mm by five years of age with growth from 1-12 months of life of 4.6mm, SPL showed smaller values in infants 6-9 months old compared to younger infants.

Fawaz and colleagues found that SPL increased gradually from a mean+ SD of 35.4 ± 4.8mm in the first year of life to 44.0 ± 4.9 mm by five years of age with growth from 1-12 months of life of 0.6cm. SPL showed smaller values in infants 6-9 months old compared to younger infants. [3]

This study detects a rapid increase in SPL in the first few months of life which reflects the effects of mini-puberty. The fact that SPL correlated positively with other anthropometric measurements suggests that SPL might be controlled by nutritional and/or hormonal factors.

Boas; et al recorded a 1 mm/month increase in SPL in the first 3 months of life due to the effect of mini puberty .[4] but we found that SPL at the age of < 2 months is 33.6 mm and in 3-4 months is 36.1 mm which means that the increase in 2 months is 2.5 mm.

Fawaz and colleagues detected a sharp increase in AGD in the first year of life with a smaller annual increase until five years. There is an increase in AGD with the progression of age except that there is a regression in AGD in the 7th and 10th months.[3]

In our study there is also an increase in AGD with age, especially in the first year of life, with AGD mean ± SD 37.6 ± 18.3 mm at the age of the first year and 74.6 ± 7.6 at the age of 10 years.

Preputial length in our study with Mean ± SD ranged from 19.9 ± 3.9 mm to 27.2 ± 3.5 mm from the first day of life to 10 years.

We have not found any previous studies done on preputial length to age.

Hutton and Ramesh found that the normal external urethral meatus extends vertically in a slit-like fashion from the tip of the penis to its inferior limit in the proximal glans as in our study .[5]

In this study meatal diameter in the first year of life ranges from 2.3 mm at 5th percentile to 4.3mm at 95th percentile, meatal diameter at the age of 10 years ranges from 3.9 mm at 5th percentile to 6.1 mm at 95th percentile, There is an increase in urethral diameter with age.

Hagan and colleagues found urethral size in neonates are 6-10 Fr and infants (1-12 months) is 10-12 Fr and children (1-10 years) is 12-14 Fr. [6]

We detected that urethral diameter at age < 2 months is 2.2 mm at 5th percentile and 4.1 at 95th percentile, meatal diameter in the 1st year of life ranges from 2.3 mm at 5th percentile to 4.3mm at 95th percentile, and meatal diameter at the age of 10 years ranges from 3.9 mm at 5th percentile to 6.1 mm at 95th percentile.

Abbas and Ali gave the length of the meatal opening was 5.3 (± 1) mm and of the ventral glans, closure was 4.8 (± 1.1) mm. They found a significant correlation between meatal opening length and glans closure length. The ventral glans closure is equivalent to or slightly less than meatal length. [7]

In this study we measured all types of meatal shapes and measured the meatal diameter, not length which gives an idea about the distensibility and elasticity of the external meatal opening.

The microphallus is characterized by a small penis and a median raphe, foreskin, as well as normal localization of the urethral meatus opening. In the USA, the incidence of micropenis was reported as 1.5 in 10000 males. [8]

In our study microphallus represents 1.13 % /3000.

Stancampiano and colleagues detect microphallus in term newborns defined as an SPL of less than 1.5 cm in Japan and Mexico, 1.8 cm in Europe, and 2.7 cm in Brazil. Perhaps 2 cm may represent a more appropriate cutoff as an international standard while bearing in mind the regional and genetic differences in puberty.[9]

In our study microphallus is detected below 5th percentiles according to age for example less than 27mm at the age of first 2 months. There is a significant relationship between hypogonadism and microphallus.

Eroglu and colleagues reported the incidence of isolated penile torsion 200/1000 among healthy children between 2011 and 2014.[10]

Bhat and colleagues reported the incidence of isolated penile torsion was 1.97% and the left-to-right ratio was 3:1, but for moderate torsion, it was 5:1.[11]

The reported cases of penile rotation are 114 / 3000, penile rotation to the right represented about 0.6% and to the left represented about 3.2%. Penile rotation to the left is more common than the penile rotation to the right at about 5:1. The degree of penile rotation varied from 15° to more than 90°. Some of these children needed surgical correction.

Donnahoo et al. reported a considerable number of patients with isolated congenital penile curvature. Among the 87 patients included 84% had ventral, 11% had dorsal, and 5% had lateral penile curvatures.[12]

We reported 40 cases of penile curvature among the 3000, in the form of dorsal, ventral, and lateral penile curvatures. It represents about 1.3%. Some of these cases needed surgical correction in the form of complete degloving of the penis, plication, or wedge shape resection of the corpora.

Gatti reported that the hypospadias incidence is 1: 250 and this percentage is duplicated in the next 23 years in the USA. Although some have suggested that this doubling reflects increased reporting of minor grades of hypospadias, an increase in severe hypospadias was also noted.[13]

In our study the reported cases of hypospadias are 58 / 3000 which represents about 1.9%, including glanular, coronal, subcoronal, anterior penile, and megameatus intact prepuce hypospadias.

A megameatus intact prepuce (MIP) is characterized by a widely splayed coronal or subcoronal meatus, a deep glanular groove, a normally conformed prepuce, and no chordee.[14]

In our study megameatus Intact Prepuce Variant of Hypospadias are 12 cases which represent 0.4% including glanular, coronal, or subcoronal.

In this study, the reported cases of megameatus are 28 cases among the 3000 which represents about 0.9%. These cases include hypospadic and non-hypospadic megameatus.

Meatal stenosis defined as a meatal diameter less than 5 French may be a complication of circumcision. The incidence of meatal stenosis is difficult to know with precision. Some series found that meatal stenosis post circumcision occurred up to 20%.[15]

In our study the reported cases of meatal stenosis are 16 cases among the 3000 which represents about 0.5%, meatal stenosis may be acquired or congenital.

Fahmy reported that double meatus may represent an incomplete urethral duplication. Detection of the double meatus is important to rule out cases of actual urethral duplication. In this anomaly, the proximal orifice is the actual urethral orifice connected to the bladder. [16]

In our study the reported cases of double meatus are 6 cases among the 3000 which represents about 0.2%. These cases were not associated with hypospadias and did not need surgery, and reassurance of family was done.

Parameatal urethral cysts are defined as rare benign lesions. They are often asymptomatic but can present with obstructive symptoms. They may resolve spontaneously or need management.[17]

In our study the reported cases of Parameatal Urethral Cyst are 2 cases among the 3000 which represents about 0.06%, excision of the cyst was done for one of them.

Fahmy evaluated the relationship between median raphe anomalies and genitourinary anomalies. Median raphe anomalies are identified in 57 cases (2%). Also, eighteen patients were diagnosed with hypospadias, five patients with renal anomalies three had limb deformities.[18]

In our study the reported cases of median raphe anomalies are 132 cases which represent about 4% deviation of median raphe represents about 3.2%, splitted median raphe represents about 0.5%, absent median raphe represents about 0.06%, prominent median raphe represents about 0.6%. These results show that median raphe deviation is the most common anomaly of median raphe and is associated with other anomalies such as penile rotation and hypospadias.

Cryptorchidism is characterized by an empty one or both scrotum. It is the most common genital anomaly found in the male. It represents about 3% of full-term and 30% of preterm male infants. About 80% of undescended testes descended in the third month of life. so the true incidence is about 1%.[19]

We reported 72 cases of cryptorchidism among the 3000 which represents about 2.4%. RT cryptorchidism represents about 1.3% and LT cryptorchidism represents about 1.1%, including palpable and impalpable, unilateral or bilateral. Rt cryptorchidism was more common than Lt cryptorchidism. Retractile testes represent about 0.2%. There is a significant correlation between cryptorchidism and scrotal hypoplasia. One case in our study represented by torsion undescended testicle and it could not be salvaged.

Osifo reported the incidence of hydrocele among 2715 neonates who were circumcised Neonatal hydrocele was bilateral in 112 (68.7%), and there were 20 (12.3%) right and 31 (19.0%) left. the 163 cases of hydrocele. [20]

In our study the reported cases of hydrocele are 324 / 3000, Rt hydrocele represents about 5.5%, and Lt hydrocele represents about 5.3%.

In our study the reported cases of hernia are 10 cases among the 3000, Rt hernia represents about 0.13%, and Lt hernia represents about 0.2%.

In this study, the reported cases of the bifid scrotum are 2 cases among the 3000 which represents about 0.06%. Scrotal hypoplasia is 12 cases which represents about 0.4%. There is a significant relationship between cryptorchidism and scrotal hypoplasia.

Mostafa and colleagues reported one case of prepubic sinus of a 2-year-old boy that was managed by surgical excision. [21]

We found one case of prepubic sinus among the 3000 which represents about 0.03% and was managed by surgical excision.

CONCLUSION

This study gives value reference and percentile curves for stretched penile length (SPL), AGD, Preputial length, meatal diameter, and glans closure length in healthy Egyptian males from the age of one day to 10 years.

There is a significantly strong correlation between the glans closure line length and the length of the dorsal glans.

The incidence of urogenital anomalies among studied children is about 18.4%. This percentage reflects the awareness of the parents of urogenital anomalies

There is no role of hormonal assessment in external genitourinary anomalies studied in this study except for microphallus and UDT.

The knowledge of the incidence of congenital anomalies is important for planning health services in our country.

Conflict of interest : none

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