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The use of testicular prostheses in boys

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Abstract

Lack of the testis is an important factor in psycho-sexual development of the boys, and implantation of the prosthesis plays a very essential role in the treatment of that group of patients. Currently there are no standards regarding when prosthesis should be implanted, and which access is connected with minimal rates of complications. We present our experience of primary prosthesis implantations in boys treated in our department.

From 2000 to 2014, primary implantation of the testicular prosthesis was performed in 290 boys. The early and late post-operative complications and long-term therapeutic results were analyzed, considering age at the time of implantation, the time between the initial operation and implantation of the prosthesis, and the surgical approach.

Best results were observed in 267 patients and bad outcome in 23 patients. Prosthesis implantation in young boys operated within the first three years of life or during the first year after primary surgery was connected with statistically fewer complications ($P = .002$ and $P < .05$, respectively). Supra-scrotal access was connected with the lowest rate of complications ($P = .01$).

Long-term therapeutic results in boys with testicular prostheses were good in the majority of cases. Implantation of the first prosthesis should be performed early between 1 and 3 years of life in boys with lack of the testis. Implantation of a prosthesis should also be performed within 1 year after removing of testis or during orchiectomy. Supra-scrotal access should be chosen for testicular prosthesis implantation due to the best long-term results.

Abbreviations: c = cases, No. = number, p = p value.

Keywords: anorchia, boys, orchiectomy, testicular prosthesis

1. Introduction

Testicular prostheses have been widely used for many years in pediatric patients lacking a testis or testes. Agenesis of a testis, excision of the hypoplastic or atrophic testis, torsion and necrosis of a testis, post-traumatic conditions (accidental, intentional, and iatrogenic), and post-inflammatory or neoplastic changes (primary or metastatic tumor) are the most frequent indications for implantation. Testicular prostheses can also be useful in the treatment of children with disorders of sex differentiation if the male sex is chosen when there are no testes, or if it is necessary to excise dysgenetic gonads.[1–4]

Kogan has reviewed the technical, legal, and medical issues of testicular prostheses, including metal and silicone ones.[5] The first report of testicular prosthesis implantation in boys was published by Gilbert and Mencia.[6]

Implantation of the prosthesis in childhood and adolescence is considered safe if the proper implant size is selected, the correct surgical access is used, and adequate post-operative treatment is provided.[7–10] A good cosmetic result has a positive impact on the psycho-sexual development of young boys and those in puberty.[5,9–13]

There are no widely accepted standards for the appropriate age for prosthesis implantation or the time between the excision of a testis and insertion of an implant. However, early implantation is generally considered beneficial.[7,8,11,13,14]

This study was designed to address the following questions about results of prosthetic treatment in boys lacking testes.[1] What are the long-term results of testicular prostheses implantation in boys?[2] What are long-term results according to the age of a patient at the moment of implantation?[3] What are the long-term results according to the time between first operation (excision or searching for a testis) and implantation of a prosthesis?[4] What are the long-term results according to surgical access?

2. Materials and methods

From 2000 to 2014, the primary implantation of the testicular prosthesis was performed in 290 boys in our department. The indications for implantation of the prosthesis was lack of a testis due to: (1) an anomaly – agenesis or testicular hypoplasia, (2) torsion of the spermatic cord and testicular necrosis, (3) testicular atrophy after orchiopexy of undescended testis, (4) testicular injury, or (5) testicular neoplasm.

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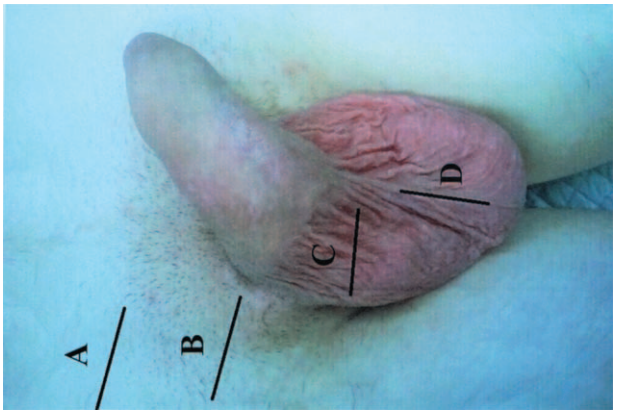

Figure 1. Surgical approach: (A) inguinal, (B) supra-scrotal, (C) transverse scrotal, and (D) trans-septal scrotal.

Patients were divided into two age groups: Group 1 (1–3 years old) and Group 2 (4–16 years old). They were also divided based on the time between the first operation (excision or searching for a testis) and implantation of the prosthesis: Group A ($\leq$1 year) and Group B (>1 year), according to suggestion of Peycelon et al.[7]

The surgeon chose one of four accesses: inguinal, supra-scrotal, transverse scrotal, or trans-septal scrotal (Fig. 1).

The surgical technique. In all patients, testicular prostheses filled with a highly-flexible liquid silicone and coated with a highly-polymerized silicone were used. Prostheses were available in five sizes: 20×22 mm, 26×33 mm, 32×42 mm, 33×48 mm, and 39×50 mm. Size of an implant was individually chosen for every patient according to preoperative ultrasound examination, where the diameter and volume of the testis were assessed. Then the surgeon chooses the operative access. Space in the scrotum was produced by blunt dissection and then expanded with a balloon of Foley's catheter, which also acted as a hemostatic. An eye was at one tip of the prosthesis, which allows the dragging of a stay suture, anchoring the prosthesis to the bottom of the scrotum and preventing migration (Fig. 2). The wound was closed in as many layers as possible with single knotted absorbable sutures.

General management. Antibiotic was administered intravenously to the patient on the day of surgery and on the following day when the patient was discharged from the hospital. An oral antibiotic was recommended for 5 days, dressing change every 2 days, and limitation of physical activity for 1 month were advised. The first visit to the outpatient clinic took place 1 week after discharge, and the next visits – according to condition of the patient.

Follow up. Post-operative complications were divided into early (wound infection, delayed healing, skin necrosis) and late (migration of the prosthesis in the direction of the groin, partial unveiling of the prosthesis, prolapse of the prosthesis). Complications were analyzed regarding patient's age at the moment of implantation (Groups 1 and 2) and the time between the first operation and implantation of the prosthesis (Groups A and B). We also analyzed the rate of complications connected with surgical approach. Long-term results of treatment were evaluated after 2 years from prosthesis implantation. A good outcome was considered as low scrotal position of the prosthesis, size of the prosthesis comparable to healthy, contralateral testis, and tidy post-operative scar (Figs. 3 and 4). A bad outcome included the prosthesis displaced in the direction of the groin, partial unveiling, or prolapse of the prosthesis.

Statistical analysis of complications was performed using the commercial software Excel Statistica Statsoft 8.0. The categorical variables were presented as counts and percentage. The categorical variables were compared using a chi-square test with Yates amendment. A *P*-value of $<.05$ was considered statistically significant.

Local Research Bioethics Committee of Medical University approved this study – protocol with informed consent (No. KE – 0254/247/2017).

3. Results

The number of patients who undergone the primary implantation of testicular prostheses has been gradually growing (Fig. 5). The prosthesis was exchanged in 145 boys (50%), of which 108 boys (37%) had the prosthesis exchanged once and 37 boys (13%) had it exchanged twice. Here, only the primary implantation results were investigated.

Lack of a testis due to an anomaly – agenesis or testicular hypoplasia was the indication for implantation of the prosthesis in 144 boys (49%), due to torsion of a spermatic cord and testicular necrosis – in 72 boys (25%), due to testicular atrophy after orchiopexy of undescended testis – in 30 boys (11%), due to

Figure 2. Anchoring of the prosthesis to the bottom of the scrotal sac.

Figure 3. Long-term result of treatment in a toddler.

Figure 4. Long-term result of treatment in a teenager.

testicular injury – in 29 boys (10%), and due to testicular neoplasm – in 15 boys (5%).

Age of our patients at the moment of implantation ranged 1–16 years; median = 6.8 years (Table 1). Age of Group 1 consisted of 96 boys (33%) and age of Group 2 consisted of 194 boys (67%).

In 183 boys (63%), the time between the first operation and implantation of the prosthesis was less or equal to 1 year (Group A) and in 107 boys (37%) was over 1 year (Group B).

The most frequent surgical approach was an inguinal one in 107 boys (37%). The supra-scrotal approach was used in 86 boys (30%), transverse scrotal in 72 boys (25%), and trans-septal scrotal in 25 boys (8%).

Among 290 boys with primary testicular implants, early complications were noted in 45 cases (15%); mainly infection of the wound (Table 2). Late complications occurred in 23 boys (8%); mainly displacement of a prosthesis. Partial unveiling or prolapse of a prosthesis were long-term consequences of delayed wound healing or skin necrosis.

Early complications were more frequent than late complications ($P = .0285$).

Table 3 presents complications regarding the age of a patient at the moment of implantation. Among early complications, wound infection, delayed wound healing, and skin necrosis occurred mostly in Group 2. Also among late complications, displacement of a prosthesis, partial unveiling, and prolapse of a prosthesis occurred mainly in Group 2. The age of the patient had a significant influence on the frequency of complications. Early complications occurred statistically more frequently in Group 2 than in Group 1 ($P = .012$). There was no statistical significance in late complications between age groups ($P = .18$). Complications in general were statistically more frequent in Group 2 than in Group 1 ($P = .002$).

Table 4 presents complications regarding the time between the first operation and implantation of a prosthesis. That time had a statistical significant influence on the frequency of complications. Early and late complications, also complications in general occurred more often in patients with testicular prostheses implanted later than 1 year since the first operation – Group B ($P = .00$).

Table 5 presents complications according to the surgical access. Supra-scrotal access was concerned by us as the safest method of implantation regarding all (early and late) complications. Complications in patients operated with supra-scrotal access were statistically less frequent than in those with transverse access ($P = .01$).

Good treatment results were achieved in 267 patients (92%). Bad long-term results were observed in 23 patients (8%). Prolapse of prostheses occurred in 4 boys and the partial unveiling of a prosthesis in 5 boys. In all of these cases, the prostheses were removed. In 14 patients, groin displacement of prostheses was observed and required surgical correction.

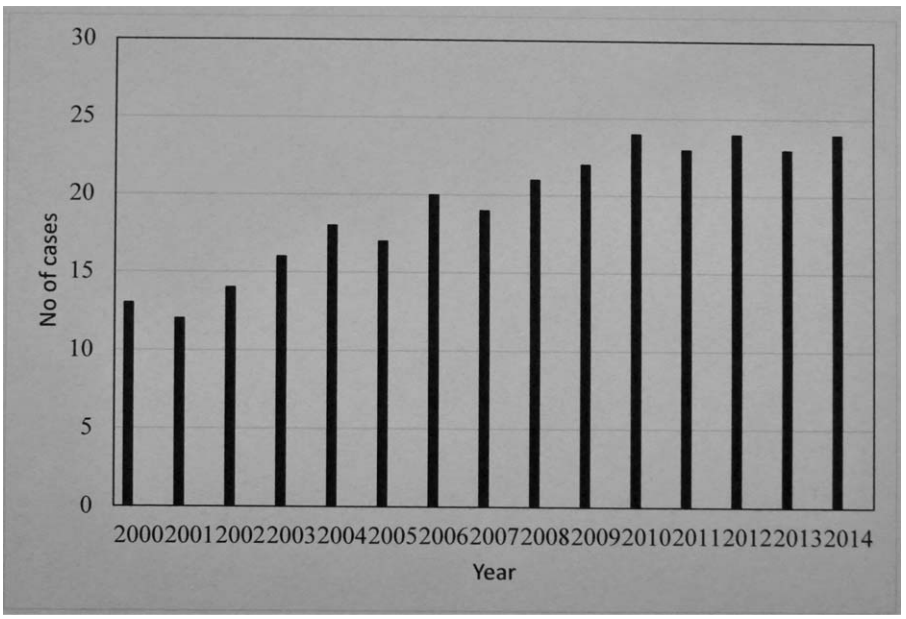

Figure 5. The number of primary implantations of testicular prostheses in consecutive years.

Table 1

Age groups of operated boys.

Age group	Age (years)	Number of boys
1	1–3	96
2	4–16	194

Table 2

Complications associated with use of testicular prostheses in boys.

Complications	No. of cases
Early	
Infection of the wound	20 (6.8%)
Delayed wound healing	11 (3.7)%)
Skin necrosis	14 (4.8%)
Together	**45 (15%)**
Late	
Displacement of a prosthesis	14 (4.8%)
Partial unveiling of a prosthesis	5 (1.7%)
Prolapse of a prosthesis	4 (1.3%)
Together	**23 (8%)**

Table 3

Complications according to the age of a patient at the moment of implantation.

	Age group		
	1 (96 c)	2 (194 c)	
Complications	No. of cases (%)	No. of cases (%)	X^2 test
Early			
Infection of the wound	3 (3)	17 (9)	
Delayed wound healing	1 (1)	10 (5)	
Skin necrosis	2 (2)	12 (6)	
Together	**6 (6)**	**39 (20)**	$P = .012$
Late			
Displacement of a prosthesis	4 (4)	10 (5)	
Partial unveiling of a prosthesis	–	5 (3)	
Prolapse of a prosthesis	–	4 (2)	
Together	**4 (4)**	**19 (10)**	$P = .18$
Complications in general	**10 (10)**	**49 (25)**	$P = .002$

c = cases.

Table 4

Complications according to the time of the first operation and implantation of a prosthesis.

	Time		
	Group A ≤1 year (183 c)	Group B >1 year (107 c)	
Complications	No. of cases (%)	No. of cases (%)	X^2 test
Early			
Infection of the wound	6 (3)	14 (13)	
Delayed wound healing	3 (1.5)	8 (7)	
Skin necrosis	4 (2)	10 (9)	
Together	**13 (7)**	**32 (30)**	$P = .00$
Late			
Displacement of a prosthesis	3 (1.5)	11 (10)	
Partial unveiling of a prosthesis	1 (0.5)	4 (3.5)	
Prolapse of a prosthesis	–	4 (3.5)	
Together	**4 (2)**	**19 (18)**	$P = .00$
Complications in general	**15 (8)**	**43 (40)**	$P = .00$

c = cases.

4. Discussion

Publications describing testicular implants in boys are based on between several to 100 cases.[2,5,7–9,11,13,15,16] Our study consists of 290 boys after primary testicular prosthesis implantation.

The most common indications for implantation of prostheses are anomalies of testicular development (agenesis and hypoplasia),[7,9,12–15,17,19] followed by spermatic cord torsion and testicular atrophy after orchiopexy.[7,8,15] Injury and neoplastic disease are infrequent indications for the implantation of testicular prostheses.[15,18,20] Our data are in line with the above-cited findings. Patients with disorders of sex differentiation are rare recipients of testicular prostheses.[1–4] In our study, there were no boys with such disorders.

Lattimer and Puranik et al independently introduced in 1973 the most popular prostheses made of silicone sheath and silicone gel filling (elastomer).[5,21] Other prostheses were made of solid silicone, silicone sheath with normal saline filling, or polyurethane sheath with silicone gel filling.[5,10] Martín-Crespo Izquierdo et al proposed multiple injections of hyaluronic acid gel inside a scrotal sac, which played the role of an expander.[17] We used prostheses made of silicone sheath with liquid silicone filling.

Kogan, Peycelon et al, Rose et al and Ferro et al preferred inguinal access for implantation of a prosthesis.[5,7,9,22] Kogan also described transverse scrotal, supra-scrotal, and trans-raphe scrotal access.[5] According to Bush et al trans-raphe scrotal access is useful during combined orchiectomy (due to torsion and necrosis of a testis) with implantation of a prosthesis and contralateral prophylactic orchiopexy.[8] We chose mainly inguinal access because many of the boys had been initially operated with inguinal incision. Rarely, we used supra-scrotal or transverse scrotal access. Trans-septal scrotal access was performed only in selected cases.

The size of an implant is usually selected based on the measurement of healthy testis with an orchidometer.[5] After skin incision, the subcutaneous tissue, fasciae, and scrotal sac are dissected with blunt preparation. A prosthesis is fixed to the inside surface of the scrotum with a stay suture dragged through the eye of a suture tab localized at one pole of the prosthesis. However, one should be careful with this suture, especially in small boys, who have thin and delicate scrotal skin. It is also necessary to close the wound in layers: dartos fascia, canal to the scrotum, Scarpa's fascia, subcutaneous tissue, and the skin.[5] Kogan and Bush et al advised intravenous antibiotic perioperatively and then orally for 3–5 days.[5,8] Our technique was similar. However, we chose the size of a prosthesis based on ultrasound measurements of the contralateral testis and additionally distended scrotal sac with a balloon of Foley's catheter, which also acts as a hemostatic.

There is no consensus on the optimal age for the implantation of testicular prostheses. Kogan, Martínez et al, Elder et al, Emir et al, and Martín-Crespo Izquierdo et al preferred to perform the surgery in toddlers and preschool boys,[5,11,13,14,17] whereas Sharma et al, Gupta et al, and Peycelon et al suggested that it was better to implant prosthesis in teenagers.[1,2,7] We distinguished in our study two age groups: Group 1, 1–3 years old; Group 2, 4–16 years old. This age distribution was connected with indication to surgery. In Group 1 patients with developmental anomalies of the testis prevailed. Testicular atrophy, torsion of the testis, injury, or neoplasm prevailed in Group 2. Disregarding the above factors, we assume that implantation of the prosthesis done at an earlier age is more feasible and gives better results.

Table 5

Complications according to the surgical access.

Complications	Surgical access			
	Inguinal (107 c) No. of cases (%)	Supra-scrotal (86 c) No. of cases (%)	Transverse scrotal (72 c) No. of cases (%)	Trans-septal scrotal (25 c) No. of cases (%)
Early				
Infection of the wound	9 (8)	2 (2)	8 (11)	1 (4)
Delayed wound healing	7 (6)	4 (4)	–	–
Skin necrosis	3 (3)	2 (2)	8 (11)	1 (4)
Together	**19 (18)**	**8 (9)**	**16 (22)**	**2 (8)**
Late				
Displacement of a prosthesis	10 (9)	3 (3)	1 (1)	–
Partial unveiling of a prosthesis	–	–	4 (5)	1 (4)
Prolapse of a prosthesis	–	–	4 (5)	–
Together	**10 (9)**	**3 (3)**	**9 (13)**	**1 (4)**
Complications in general				
		$P = .464$		
X^2 test			$P = .01$	
				$P = .80$

c = cases.

Kogan, Bush et al, Rose et al, Martínez et al, and Elder et al have emphasized the necessity to exchange prostheses in adolescence.[5,8,9,11,13] We exchanged prostheses once in 108 patients and twice in 37 patients. Therefore, in total, we performed 435 testicular implants in 290 boys.

Opinions about time delay between the initial operation and implantation of a prosthesis differ. Kogan advised simultaneous implantation of a prosthesis with planned orchiectomy due to the hypoplastic testis or benign, low-stage neoplastic tumor when the prosthesis of appropriate size is available, and the surgeon can discuss with parents regarding details of the procedure before the start of an operation.[5] Emir et al, Mohammed et al, and Musi et al also advised simultaneous orchiectomy and implantation.[14,15,19] However, decisions about implantation are often delayed by the patient or their parents. Shaw proposed the use of an inflatable expander before an implant.[18] Peycelon et al stated that the delay should be no longer than 1 year because of some complications connected with waiting.[7] In our study the time delay of less than 1 year concerned 63% boys and was connected with statistically fewer post-operative complications than the rest of boys, who were waiting over 1 year.

Post-operative complications in boys with testicular implants are rather rarely described. Kogan highlighted the risk of rupture of a prosthesis with silicone leakage.[5] Peycelon et al presented complications such as migration and extrusion of a prosthesis or wound infection.[7] Turek and Master warned against pulmonary embolism.[10] Mohammed et al pointed to lack of meticulous follow-up in these patients.[15] Studies of Henderson et al and Pidutti and Morales described immunological-systemic response to silicone implants, but their findings were not conclusive because of the possibility of associated immune disorders.[16,23] Genest et al wrote that the prosthesis, like any other alien body, activated local reaction of tissues, which resulted in the formation of a two-layered capsule consisting of collagen fibers containing particles of silicone.[24] We divided post-operative complications among our patients into early and late. Early complications (infection of the wound, delayed wound healing, and skin necrosis) occurred in 15% of boys. Late complications (displacement of a prosthesis, partial unveiling, and prolapse of a prosthesis) occurred in 8% of boys.

Kogan and Bush et al presented studies on long-term therapeutic results in boys with testicular implants.[5,8] According to Kogan good results concerned 97% of patients.[5] Bush et al achieved good results in 91%.[8] In our study we achieved good long-term results in 92% of patients but 8% of boys with bad results required additional surgical procedures.

Implantation of the testicular prosthesis has a beneficial influence on the development of a young man and prevents psycho-sexual trauma.[5,9,10–13,20,25] Gritz et al have found that some of the married men paid little attention to the appearance of their genitals, and refused an offer of testicular implant.[20]

Limitation of our investigation was heterogeneity of the study group connected with primary pathology of the testis and age of the patients. In our study was only one cohort. We had neither second cohort nor case-control group. The advantage of the study was the large size of the cohort. The applied divisions of patients allowed to formulate conclusions helpful in determining the optimal age of patients, time between the first operation and implant placement, as well as surgical access in implantation of testicular prostheses.

5. Conclusion

Long-term therapeutic results in boys with testicular prostheses were good in the majority of cases. Implantation of the first prosthesis should be performed early between 1 and 3 years of life in boys with lack of the testis. Implantation of a prosthesis should also be performed within 1 year after removing of testis or during orchiectomy. Supra-scrotal access should be chosen for testicular prosthesis implantation due to the best long-term results.

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Visualization: Paweł Osemlak.
Writing – original draft: Paweł Osemlak.
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References

[1] Sharma S, Gupta DK. Male genitoplasty for 46 XX congenital adrenal hyperplasia patients presenting late and reared as males. Indian J Endocrinol Metab 2012;16:935–8. doi: 10.4103/2230-8210.102994.

[2] Gupta D, Bhardwaj M, Sharma S, et al. Long-term psychosocial adjustments, satisfaction related to gender and the family equations in disorders of sexual differentiation with male sex assignment. Pediatr Surg Int 2010;26:955–8. doi: 10.1007/s00383-010-2661-y.

[3] Fernández-Fernández J, Pachano-Arenas F, Chacín-Fuenmayor J, et al. Bilateral gonadectomy and laparoscopic hysterosalpingectomy in an adolescent with ovotesticular disorder of sexual development. Invest Clin 2009;50:507–11.

[4] Amrani M, Renoirte P. [True hermaphroditism. Late diagnosis. Surgical treatment and a 15-year follow-up]. Chir Pediatr 1990;31:279–83.

[5] Kogan S. The clinical utility of testicular prosthesis placement in children with genital and testicular disorders. Transl Androl Urol 2014;3:391–7. doi: 10.3978/j.issn.2223-4683.2014.12.06.

[6] Gilbert M, Mencia LF. Artificial testicles in children. South Med J 1969;62:611–4.

[7] Peycelon M, Rossignol G, Muller CO, et al. Testicular prostheses in children: is earlier better? J Pediatr Urol 2016;12:237e1-6. doi: 10.1016/j.jpurol.2016.04.022.

[8] Bush NC, Bagrodia A. Initial results for combined orchiectomy and prosthesis exchange for unsalvageable testicular torsion in adolescents: description of intravaginal prosthesis placement at orchiectomy. J Urol Oct 2012;188(Suppl):1424–8. doi: 10.1016/j.juro.2012.02.030.

[9] Rose M, Aberg M, Bohn J. Testicular prosthetic implants in boys and teenagers with primary or secondary anorchism. Scand J Plast Reconstr Surg Hand Surg 2008;42:101–4. doi: 10.1080/02844310701811274.

[10] Turek PJ, Master VA. Safety and effectiveness of a new saline filled testicular prosthesis. J Urol 2004;172(Pt 1):1427–30.

[11] Martínez Y, Millán A, Gilabert R, et al. Study of satisfaction of testicular prosthesis implantation in children. Cir Pediatr 2012;25:20–3.

[12] Tsvetkov D, Tsvetkova P. [Congenital anorchism – the diagnostic and treatment problems]. Akush Ginekol (Sofiia) 1990;29:45–51.

[13] Elder JS, Keating MA, Duckett JW. Infant testicular prostheses. J Urol 1989;141:1413–5.

[14] Emir H, Ayik B, Eliçevik M, et al. Histological evaluation of the testicular nubbins in patients with nonpalpable testis: assessment of etiology and surgical approach. Pediatr Surg Int 2007;23:41–4.

[15] Mohammed A, Yassin M, Hendry D, et al. Contemporary practice of testicular prosthesis insertion. Arab J Urol 2015;13:282–6. doi: 10.1016/j.aju.2015.09.001.

[16] Henderson J, Culkin D, Mata J, et al. Analysis of immunological alterations associated with testicular prostheses. J Urol 1995;154:1748–51.

[17] Martín-Crespo Izquierdo R, Luque Pérez AL, Ramírez Velandia H, et al. Hyaluronic acid scrotoplasty: minimally-invasive procedure to enhance the volume of scrotum until puberty. Cir Pediatr 2014;27:11–5.

[18] Shaw MB, Sadove AM, Rink RC. Reconstruction after total penile amputation and emasculation. Ann Plast Surg 2003;50:321–4. discussion 324.

[19] Musi L, D'Agostino S, Cimaglia ML, et al. [Nonpalpable testis: current diagnostic and therapeutic trends]. Pediatr Med Chir 1994;16:513–6.

[20] Gritz ER, Wellisch DK, Wang HJ, et al. Long-term effects of testicular cancer on sexual functioning in married couples. Cancer 1989;64:1560–7.

[21] Puranik SR, Mencia LF, Gilbert MG. Artificial testicles in children: a new silastic gel testicular prosthesis. J Urol 1973;109:735–6.

[22] Ferro F, Caterino S, Lais A. Testicular prosthesis in children: a simplified insertion technique. Eur Urol 1991;19:230–2.

[23] Pidutti R, Morales A. Silicone gel-filled testicular prosthesis and systemic disease. Urology 1993;42:155–7.

[24] Genest H, Guidoin R, Plante R, et al. [Analysis of silicone testicular implants after explantation]. J Urol (Paris) 1982;88:337–43.

[25] Weissbach L, Janssen PL, Bach D. [Implantation of a testicular prosthesis. Psychological aspects]. Urologe 1979;18:151–6.