Journal of Pediatric Urology (2019) 15, 377.e1—377.e6

Surgery for no palpable testis before the age of one year: a risk for the testis?

J.B. Marret [a,b,*], P. Ravasse [a,b], M. Boullier [a], M. Blouet [c], N. Dolet [a], T. Petit [a], J. Rod [a,b]

[a]Department of Pediatric Surgery, University Hospital of Caen, Avenue de la Côte de Nacre, 14 032, Caen cedex 9, France

[b]Caen University Hospital, Avenue de la Côte de Nacre, 14 000, Caen, France

[c]Department of Pediatric Radiology, University Hospital of Caen, Avenue de la Côte de Nacre, 14 032, Caen cedex 9, France

* Corresponding author. Department of Pediatric Surgery, University Hospital of Caen, Caen University Hospital, Avenue de la Côte de Nacre, 14000, Caen, France. Tel.: +33231064483; fax: +33231065077. marret-jb@chu-caen.fr (J.B. Marret)

Keywords
No palpable testis; Ultrasound; Atrophy; Pediatric surgery

Received 17 October 2018
Revised 27 February 2019
Accepted 25 March 2019
Available online 29 March 2019

Summary

Introduction
Surgery for undescended testis is now commonly recommended before the age of one year. However, the risk of testicular atrophy or miss location after surgery at a young age has not been clearly evaluated.

Objective
The objective of this study is to evaluate the rate of testicular atrophy after surgery for non-palpable testis before the age of one year.

Materials
Fifty-five patients operated between 2005 and 2014 for non-palpable testes were reviewed for clinical and ultrasound (US) evaluation. Median follow-up after surgery was of 68.5 months (range 26—130 months). The median age at surgery was of months (5—12 months). Eight patients (14.5%) had bilateral non-palpable testis; thus, 63 testes were evaluated. At surgery, 38 (60%) testes were located in the high inguinal canal; 25 (40%), in the abdominal cavity. Orchiopexy was performed with preservation of the testicular vessels for 58 testes. Fowler—Stephens (FS) procedure was performed for 5 testes. Testicular location was clinically evaluated, and testicular volume was measured using a standard sonogram technique in our pediatric radiology department. Ratio comparing the volume of the descended testis to the spontaneously scrotal located testis was calculated in unilateral forms.

Results
After surgery, testes had scrotal location in 62 cases and inguinal location in one case. Seven cases of atrophy were confirmed after US control (11%), more frequently (odds ratio, OR 11.68 [1.9—72.5]) in abdominal testis (24%) than in inguinal testis (2.6%). Atrophy testicular was more frequent with FS technique (OR 7.1 [1.3—40.1]), but the population was weak ($N = 5$). Median volume ratio for unilateral form was 0.88 [0—1.8]; 14 patients presented a ratio greater than 1.

Discussion
The influence of the young age at surgery and the risk of post operative testicular atrophy had not been clearly evaluated. The term of ‘no palpable testis’ supports an heterogeneous group mixing abdominal and extra-abdominal testis sharing a uniform clinical presentation. Our rate of atrophy in the group of abdominal testes (24%) and inguinal testes (2.6%) is similar to the literature, which concerns older patients. The long-term sonogram assessment demonstrated a good development of the testis after surgery, especially in inguinal cases.

Conclusion
Surgery for no palpable testis before the age of one year does not lead to a superior risk of testicular atrophy compared with surgery at an older age and allows a good development of the testis.

Table : Risk factors for testicular atrophy.

	Normal volume	Testicular atrophy	OR*
Location			11.7 [1.9—72.5]
Inguinal	37	1	
Abdominal	19	6	
Laterality			2.5 [0.5—11.8]
Right	43	4	
Bilateral	13	3	
Surgery			7.1 [1.3—40.1]
One-stage	53	5	
Fowler—Stephens	3	2	

OR*, odd ratio; 95% CIs, 95 percent confidence intervals.

https://doi.org/10.1016/j.jpurol.2019.03.019
1477-5131/

Introduction

An undescended testis (UDT) is the most common congenital malformation of the genital tract in boys. A UDT concerns 3–5% of full-term newborns, and the incidence decreases to 1.5–3% at the age of 6 months because of postnatal migration [1,2]. Fertility and the prevention of malignant risk are the main goals of surgically bringing down the testis into the scrotum. Several studies demonstrated on testicular biopsy that the number of germ cells decreased with the age at surgery [3,4], with a high risk in non-palpable testes [5]. Inhibition of the transformation of gonocytes into adult dark spermatogonia in the UDT is also a crucial event leading to later infertility [4,6]. Adverse effects in cases of malposition of the testis on testicular development is well known [7] and become more evident with the number of years of malposition as reported by Kirsch et al. [8] in a group with abdominal testes. The benefit of young age at surgery (9 months) for testicular growth was well documented with ultrasound (US) measurements in a Swedish prospective study [9]. Wide consensus exists among the international scientific groups involved in this pathology for surgery at a young age, primarily between 6 and 12 months [10–12] or before 18 months [13–15]. The British Association of Pediatric Urology recommended a younger age for surgery in 2011 and stated that 'orchidopexy can occur within 3–6 months, although surgery between 6 and 12 months is acceptable' [16]. Independent of the debated but unknown risks and consequences of general anesthesia before 1 year, one major question related to these recommendations is the risk for testicular atrophy or missed location after surgery at a young age. Carson et al. [17] reported in a retrospective study in 2014 that there was no difference in outcomes between cases operated before 1 year and cases operated later in a series that mixed all anatomic forms of UDT. In 2018, Allin et al. [18], in a review and meta-analysis, compared the outcomes of orchiopexy before and after 1 year and concluded that there was no superior risk of atrophy in patients younger than one year.

We optimized our practice for the evaluation of the morphological results in a group of patients who underwent surgery before the age of one year for a non-palpable testis to have a more precise evaluation. We limited the study to this clinical group despite its heterogeneous aspects, mixing abdominal, and high inguinal testes. This group represents an objective clinical situation that leads to the proposal of surgery without any objective information on the presence or location of the testis, and it may be the most challenging UDT group for surgery.

The present study evaluated the rate of testicular atrophy in children younger than 1 year and investigated the testicular growth after surgery. Our primary hypothesis was that there is no greater risk of atrophy in the group of patients operated before one year for a non-palpable testis.

Materials and methods

We defined the testis as non-palpable if it was undetectable on a preoperative clinical examination and under general anesthesia.

Characteristics of the cohort

Eighty-eight patients who underwent surgery between 2005 and 2014 for a non-palpable testis with a viable testis discovered at surgery were contacted for a specialized ultrasonographic evaluation. Fifty-five families positively responded to our request. Eight patients had a bilateral non-palpable testis, with the presence of the testis demonstrated by hormonal assessment, leading to the evaluation of 63 testes. The initial location on operative records of the non-palpable testes was abdominal in 25 cases and the proximal part of the inguinal canal in 38 cases. The median age at surgery was 9 months [5–12 months]. Three senior pediatric surgeons performed the surgeries. The orchiopexy was performed in one stage with preservation of spermatic vessels for 58 testes (92%) (through an inguinal incision in 54 cases and a laparoscopic procedure in 4 cases). The Fowler–Stephens (FS) procedure was performed in 5 cases (one stage, 3 cases; two stages, 2 cases) that were all abdominal.

Evaluation methods

The evaluations were performed at a minimal follow-up of 2 years after surgery. Instead of our classic clinical evaluation by various surgeons, the same senior pediatric urologist performed all the physical examinations to evaluate the location of the testes.

Two senior pediatric radiologists performed US procedures using standardized techniques (high-frequency US probes (11 MHz)–GE Voluson E8) instead of examinations performed outside the study institution by multiple non-expert practitioners. Echogenicity was scored in two grades: normal (homogeneous) and abnormal (inhomogeneous). The testis was considered a prolapsed ellipsoid, and the volume was evaluated using the following formula: $\pi/6 \times \text{length} \times \text{width} \times \text{height}$. In unilateral cases, we evaluated the ratio of the volume between the operated testis and the contralateral testis located in the scrotum. In unilateral cases, testicular atrophy was defined as a volume of the operated testis that was less than 0.5 of the contralateral non-operated testis. In bilateral cases, testicular atrophy was defined as a testicular volume lower than 0.2 ml in a child over 2 years of age [18,19].

Qualitative data were compared using the Chi-squared test and Fisher's exact test when necessary. A P-value $<$ 0.05 was considered statistically significant. Odds ratios were estimated with the Cochran–Mantel–Haenszel statistics method, and the 95% confidence intervals were estimated with the Miettinen statistics method.

The study complied with the Helsinki Declaration II.

Results

Fifty-five patients were reviewed at a median follow-up of 68.5 months (range 26–130 months).

Clinical evaluation

For the clinical control, 62 of 63 testes (98.4%) were localized in the scrotum. One patient presented with a testis that was palpated in the superficial inguinal position in the context of a single high abdominal testis.

Radiological evaluation

All testes had a homogeneous structure. Two cases of microlithiasis were observed.

- Testicular atrophy (Tables 1 and 2)

The global rate of testicular atrophy was 7 of 63 (11%).

In unilateral non-palpable testes, atrophy was confirmed by US in 4 testes (8.5%), with a ratio of the volume between the operated testis and the contralateral testis located in the scrotum that was less than 0.5. Three cases were initially located in the abdominal cavity, and one-stage with vessel preservation surgery was performed for all cases.

In bilateral forms ($N = 8$), three patients presented with unilateral testicular atrophy (19%), with a testicular volume less than 0.2 ml. The initial location was in the abdominal cavity, and an FS procedure was performed for 2 testes.

- Postoperative testicular growth (Table 1)

In unilateral forms ($N = 47$), the median volume ratio was 0.88 (0–1.8), and 14 patients had a ratio greater than 1 in cases of unilateral non-palpable testes. The median volume ratio was significantly ($P = 0.002$) higher for the inguinal location (median ratio: 0.97 [0.19–1.80]) than that for testes located in the abdominal cavity (median ratio: 0.71 [0–1.11]).

Discussion

As mentioned previously, many arguments recommend UDT treatment at a young age based on the benefits for testicular function. However, surgery for UDT before one year of age raises one main concern: the risk of postoperative testicular atrophy.

Table 1 Population description according to the initial location.

	Abdominal $N = 25$	Inguinal $N = 38$	P*
Syndrome, N (%)	2 (8)	0	0.15
Median age at surgery (months)	10	8	–
Laterality, N (%)			0.02
Right	7 (28)	18 (47)	
Bilateral	11 (44)	5 (13)	
Surgery, N (%)			–
One-stage inguinal	16 (64)	38 (100)	
One-stage laparoscopy	4 (16)	0	
Fowler–Stephens	5 (20)	0	
Median age at US (months)	73.5	77	–
Testicular atrophy, N (%)	6 (24)	1 (2.6)	0.013
Median volume ratio	0.71	0.97	0.002
Volume ratio > 1, N (%)	1 (4)	13 (34)	<0.01

US, ultrasound.
$P^* = P$ value 95%.

Table 2 Population description according to the side.

	Unilateral $N = 47$	Bilateral $N = 16$	P*
Syndrome/anomalies, N (%)	2 (4)	3 (19)	
Median age at surgery (months)	9	7.5	–
Initial location, N (%)			$P < 0.05$
Abdominal	14 (30)	11 (69)	
Inguinal	33 (70)	5 (31)	
Laterality			–
Right	25 (53)	–	
Surgery			$P < 0.05$
One-stage inguinal	44	10 ()	
One-stage laparoscopy	0	4 ()	
Fowler–Stephens	3	2 ()	
Median age at US (months)	74	88.5	–
Testicular atrophy	4 (8.5)	3 (19)	0.36

US, ultrasound.
$P^* = P$ value 95%.

Penson et al. [20] performed a meta-analysis on the risk of testicular atrophy and found that the global success rate for primary orchiopexy was 96.5%. Durell et al. [21] performed a single-center prospective study and reported an overall testicular atrophy rate of 2.6% after surgery for palpable UDT without correlation with the experience of the surgeon.

Various opinions exist in the literature about the relation between the risk of atrophy and young age. Ein et al. [22] examined a series of 1400 orchidopexy surgeries performed from 1969 to 2003 and reported a testicular atrophy rate of 5% but did not find any correlation between the age at surgery and the risk of atrophy. Previously, Thorup et al. [23] demonstrated that the risk of atrophy was 4.9% in a group of children who underwent surgery between 1 and 10 years of age compared with 1.6% when the surgery was performed in children 10–16 years of age. In a more recent publication, Thorup et al. [24] found a significant difference between the median age at surgery for cases of failure by atrophy (2 years and 4 months) and the median age of successful operations (3 years and 9 months). Carson et al. [17] also questioned whether young age at orchiopexy affected the survival of the testis. These authors reported a global atrophy rate of 7.7% in their single-center study of all forms of UDT. They compared the risk of atrophy with age at surgery and location of the testis. They concluded that there was no increase in testicular atrophy in patients less than 13 months of age, and the risk of atrophy was correlated with the location of the testis: 33% were abdominal testes versus 3.7% were extra-abdominal testes.

Non-palpable testes represent 20–35% of UDT cases at one year [25]. These cases represent a heterogeneous group of extra-abdominal, abdominal, and peeping testes [26] with a wide range of difficulty in surgically bringing the testis down to the scrotum. After surgery for non-palpable testes, the risk of atrophy is usually evaluated as a result of surgery for an abdominal testis. Wide variation exists in terms of the preferred procedure and results [26,27]. The selection of surgical technique depends on the surgeon and the anatomical findings. In a single-center study, Stec et al. [27] reported an overall success of 79.5% after orchiopexy for an intra-abdominal testis with better results in cases of preservation of testicular vessels (89%) than in cases of FS (63% after FS one stage, 67% after FS two stage). Esposito et al. [28] reported a success rate of 83% for laparoscopic techniques without preservation of testicular vessels, but the testicular volume was smaller than its counterparts.

In the series, the rate of testicular atrophy was of 11% (24% in abdominal testes, 3% in inguinal testes), which is consistent with the literature, and the results did not demonstrate any increased risk of atrophy in this group of children younger than one year with non-palpable testes. Preservation of the spermatic vessels, as carried out for 92% of the testes, is probably a major factor that led to good results. Arena et al. [29] recently reported the results of surgery for impalpable testes via inguinal incision without division of the spermatic vessels, which was our approach in most cases (86%). There was no atrophy in their series of 21 cases aged 10 months to 4 years, and 2 (10%) remaining UDT testes required a second successful procedure. The authors completed clinical examinations with a US evaluation of our results in this selected population of patients treated before one year of age. This technique allows a more precise measurement of the testicular volume than the sole clinical evaluation [30]. In the group of individuals with non-palpable testes, no US preoperative measurement could be carried out, and the authors performed only one US examination at least two years after surgery. To approximate the trophicity of the operated testes, the authors evaluated the ratio between the volume of the testis after surgery and the contralateral testis only in cases of unilateral UDT ($n = 47$).

The authors defined atrophy as a ratio less than 0.5 in unilateral forms. This ratio value is debatable, and testicular atrophy has been differently appreciated in several studies. This difference may explain the difficulties in comparing results [18].

Likewise, the absence of preoperative evaluations of testicles does not allow accurate differentiation of a testis that was made atrophic from a testis that was found to be atrophic [22].

The results are very encouraging, with a median volume ratio of 0.88 and a ratio of greater than 1 in 26% of individuals after surgery. The authors have no hypothesis to explain the ratio of greater than 1 in their group. A Swedish prospective study confirmed these results [31]. The present study was limited to palpable testes, and the authors observed a significantly higher ratio of the volume between the operated UDT and the scrotal testis in the group treated at 9 months (ratio 0.82) compared with the group operated at 3 years (0.56). They also reported a significant partial catch-up growth at 4 years after orchiopexy in the group of early treatment at 9 months but not in the group of late treatment at 3 years. Kim et al. [32] investigated palpable UDT and confirmed a significant recovery of the testicular volume in the group of patients who underwent surgery between 1 and 2 years compared with patients who underwent surgery later.

The present study is original because the authors did not find any report in the literature with long-term follow-up and US evaluation of the results after surgery of non-palpable testes in the first year of life. One limitation is the lack of ultrasonographic evaluation before the surgery, but this absence was related to the pathology itself, which makes this examination imprecise [33]. Another limitation was the absence of a control group of patients who underwent surgery for non-palpable UDT at an older age in our unit. Furthermore, the results are not different from the data in the literature in a more heterogeneous population, especially with a wide age distribution, and the US volume ratio was considered as an excellent marker of testis development for unilateral cases. This study is only morphological, and data of hormonal and spermatic functions should be examined in the future.

Conclusions

In authors' experience, surgery for non-palpable testes before one year of age does not demonstrate any superior risk for testicular atrophy compared with results published for treatment at an older age. The authors also confirmed via US measurement the benefit for the testicular development of surgery at a young age.

Author statements

Ethical approval

None sought.

Funding

None declared.

Competing interest

None declared.

References

[1] Wenzler DL, Bloom DA, Park JM. What is the rate of spontaneous testicular descent in infants with cryptorchidism? J Urol 2004;171:849–51. https://doi.org/10.1097/01.ju.0000106100.21225.d7.

[2] Kollin C, Granholm T, Nordenskjold A, Ritzen EM. Growth of spontaneously descended and surgically treated testes during early childhood. Pediatrics 2013;131:e1174–80. https://doi.org/10.1542/peds.2012-2902.

[3] Cortes D, Thorup JM, Visfeldt J. Cryptorchidism: aspects of fertility and neoplasms. A study including data of 1,335 consecutive boys who underwent testicular biopsy simultaneously with surgery for cryptorchidism Horm Res 2001;55:21–7. https://doi.org/10.1159/000049959.

[4] Hadziselimovic F, Herzog B. The importance of both an early orchidopexy and germ cell maturation for fertility. Lancet 2001;358:1156–7. https://doi.org/10.1016/s0140-6736(01)06274-2.

[5] Tasian GE, Hittelman AB, Kim GE, DiSandro MJ, Baskin LS. Age at orchiopexy and testis palpability predict germ and Leydig cell loss: clinical predictors of adverse histological features of cryptorchidism. J Urol 2009;182:704–9. https://doi.org/10.1016/j.juro.2009.04.032.

[6] Huff DS, Fenig DM, Canning DA, Carr MC, Zderic SA, Snyder HM. Abnormal germ cell development in cryptorchidism. Horm Res Paediatr 2001;55:11–7. https://doi.org/10.1159/000049957.

[7] Cendron M, Huff DS, Keating MA, Snyder HM, Duckett JW. Anatomical, morphological and volumetric analysis: a review of 759 cases of testicular maldescent. J Urol 1993;149:570–3. https://doi.org/10.1016/S0022-5347(17)36151-7.

[8] Kirsch AJ, Escala J, Duckett JW, Smith GH, Zderic SA, Canning DA, et al. Surgical management of the nonpalpable testis: the children's hospital of Philadelphia experience. J Urol 1998;159:1340–3. https://doi.org/10.1016/S0022-5347(01)63613-9.

[9] Kollin C, Hesser U, Ritzen EM, Karpe B. Testicular growth from birth to two years of age, and the effect of orchidopexy at age nine months: a randomized, controlled study. Acta Paediatr 2006;95:318–24. https://doi.org/10.1080/08035250500423812.

[10] Ritzen EM, Bergh A, Bjerknes R, Christiansen P, Cortes D, Haugen SE, et al. Nordic consensus on treatment of undescended testes. Acta Paediatr 2007;96:638–43. https://doi.org/10.1111/j.1651-2227.2006.00159.x.

[11] Chan E, Wayne C, N A. FRCSC for Canadian association of pediatric surgeon evidence-based resource. Ideal timing of orchiopexy: a systematic review. Pediatr Surg Int 2014;30:87–97. https://doi.org/10.1007/s00383-013-3429-y.

[12] Braga LH, Lorenzo AJ, Romao RLP. Canadian urological association-pediatric urologists of Canada (CUA-PUC) guideline for the diagnosis, management, and followup of cryptorchidism. Can Urol Assoc J 2017;11:E251–60. https://doi.org/10.5489/cuaj.4585.

[13] Kolon TF, Herndon CD, Baker LA, Baskin LS, Baxter CG, Cheng EY, et al. Evaluation and treatment of cryptorchidism: AUA guideline. J Urol 2014;192:337–45. https://doi.org/10.1016/j.juro.2014.05.005.

[14] Elder JS. Surgical management of the undescended testis: recent advances and controversies. Eur J Pediatr Surg 2016;26:418–26. https://doi.org/10.1055/s-0036-1592197.

[15] Radmayr C, Dogan HS, Hoebeke P, Kocvara R, Nijman R, Silay S, et al. Management of undescended testes: european association of urology/European society for paediatric urology guidelines. J Pediatr Urol 2016;12:335–43. https://doi.org/10.1016/j.jpurol.2016.07.014.

[16] Murphy F. The BAPU consensus statement on the management of undescended testis. 2011. http://www.bapu.org.wk/udt-consensus-statement.

[17] Carson JS, Cusick R, Mercer A, Ashley A, Abdessalam S, Raynor S, et al. Undescended testes: does age at orchiopexy affect survival of the testis? J Pediatr Surg 2014;49:770–3. https://doi.org/10.1016/j.jpedsurg.2014.02.065.

[18] Allin BSR, Dumann E, Fawkner-Corbett D, Kwok C, Skerritt C. Paediatric surgery trainees research Network. Systematic review and meta-analysis comparing outcomes following orchidopexy for cryptorchidism before or after 1 year of age. BJS Open 2018;2:1–12. https://doi.org/10.1002/bjs5.36.

[19] Jedrzejewski G, Wieczorek AP, Osemlak P, Nachulewicz P. The role of ultrasound in the management of undescended testes before and after orchidopexy - an update. Medicine (Baltimore) 2016;95:e5731. https://doi.org/10.1097/md.0000000000005731.

[20] Penson D, Krishnaswami S, Jules A, McPheeters ML. Effectiveness of hormonal and surgical therapies for cryptorchidism: a systematic review. Pediatrics 2013;131:e1897–907. https://doi.org/10.1542/peds.2013-0072.

[21] Durell J, Johal N, Burge D, Wheeler R, Griffiths M, Kitteringham L, et al. Testicular atrophy following paediatric primary orchidopexy: a prospective study. J Pediatr Urol 2016;12:243. e1–4, https://doi.org/10.1016/j.jpurol.2016.05.023.

[22] Ein SH, Nasr A, Wales PW, Ein A. Testicular atrophy after attempted pediatric orchidopexy for true undescended testis. J Pediatr Surg 2014;49:317–22. https://doi.org/10.1016/j.jpedsurg.2013.11.048.

[23] Thorup J, Kvist N, Larsen P, Tygstrup I, Mauritzen K. Clinical results of early and late operative correction of undescended testes. Br J Urol 1984;56:322–5. https://doi.org/10.1111/j.1464-410X.1984.tb05397.x.

[24] Thorup J, Jensen CL, Langballe O, Petersen BL, Cortes D. The challenge of early surgery for cryptorchidism. Scand J Urol Nephrol 2011;45:184–9. https://doi.org/10.3109/00365599.2010.549091.

[25] Baker LA, Docimo SG, Surer I, Peters C, Cisek L, Diamond DA, et al. A multi-institutional analysis of laparoscopic orchidopexy. BJU Int 2001;87:484–9. https://doi.org/10.1046/j.1464-410X.2001.00127.x.

[26] Shepard CL, Kraft KH. The nonpalpable testis: a narrative review. J Urol 2017;198:1410–7. https://doi.org/10.1016/j.juro.2017.04.079.

[27] Stec AA, Tanaka ST, Adams MC, Pope JC, Thomas JC, Brock JW. Orchiopexy for intra-abdominal testes: factors predicting success. J Urol 2009;182:1917–20. https://doi.org/10.1016/j.juro.2009.03.069.

[28] Esposito C, Vallone G, Savanelli A, Settimi A. Long-term outcome of laparoscopic fowler-stephens orchiopexy in boys

with intra-abdominal testis. J Urol 2009;181:1851—6. https://doi.org/10.1016/j.juro.2008.12.003.
[29] Arena S, Impellizzeri P, Perrone P, Scalfari G, Centorrino A, Turiaco N, et al. Is inguinal orchidopexy still a current procedure in the treatment of intraabdominal testis in the era of laparoscopic surgery? J Pediatr Surg 2017;52:650—2. https://doi.org/10.1016/j.jpedsurg.2016.08.030.
[30] Diamond DA, Paltiel HJ, DiCanzio J, Zurakowski D, Bauer SB, Atala A, et al. Comparative assessment of pediatric testicular volume: orchidometer versus ultrasound. J Urol 2000; 164:1111—4. https://doi.org/10.1016/S0022-5347(05)67264-3.
[31] Kollin C, Karpe B, Hesser U, Granholm T, Ritzen EM. Surgical treatment of unilaterally undescended testes: testicular growth after randomization to orchiopexy at age 9 months or 3 years. J Urol 2007;178:1589—93. discussion 93, https://doi.org/10.1016/j.juro.2007.03.173.
[32] Kim SO, Hwang EC, Hwang IS, Oh KJ, Jung SI, Kang TW, et al. Testicular catch up growth: the impact of orchiopexy age. Urology 2011;78:886—9. https://doi.org/10.1016/j.urology.2011.04.057.
[33] Vos A, Vries AM, Smets A, Verbeke J, Heij H, Van der Steeg A. The value of ultrasonography in boys with a non-palpable testis. J Pediatr Surg 2014;49:1153—5. https://doi.org/10.1016/j.jpedsurg.2013.09.011.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpurol.2019.03.019.