International Urology and Nephrology (2018) 50:2139–2144
https://doi.org/10.1007/s11255-018-2006-7

UROLOGY - ORIGINAL PAPER

# Initial laparoscopy and optimized approach for unilateral nonpalpable testis: review of 8-year single-center experience

**Ahmed Zaki Mohamed Anwar[1] · Tarek Khalaf Fathelbab[1] · Amr Mohamed Abdelhamid[1] · Ehab Mohmed Galal[1] · Mostafa Magdi Ali[1] · Ehab Rifat Tawfiek[1]**

Received: 11 June 2018 / Accepted: 5 October 2018 / Published online: 11 October 2018


## Abstract

**Purpose** We evaluated the role of initial laparoscopy and optimized approach in cases of unilateral nonpalpable testis.

**Methods** Seventy-four patients with nonpalpable testes were presented. We excluded 9 patients, with palpable testes under anesthesia. Laparoscopy was offered to 65 patients. Contralateral testis hypertrophy with length ≥ 1.8 cm was confirmed in 47 patients. Ultrasound results were available for 35 patients.

**Results** Age ranged from 1 to 10 years. Of 65 nonpalpable testes, right side comprised 23 (35.4%) and the left 42 (64.6%). Laparoscopy revealed intra-abdominal testis in 18 patients (27.7%), blind-ending vessels and vas in 8 (12.3%), and vas and vessels traversing the internal ring in 39 (60%). Treatment of intra-abdominal testes included Fowler–Stephens orchiopexy in 7 patients, laparoscopic orchiopexy in 9, and laparoscopic orchiectomy in 2. In 8 patients with blind-ending vas and vessels, laparoscopy was terminated. In 39 patients with vas and vessels traversing the internal ring, scrotal exploration was performed in 36 patients with closed internal ring and inguinal exploration in 3 with open internal ring. Vanished testes were present in 43/47(91.5%) of patients with contralateral testis hypertrophy ≥ 1.8 cm. Ultrasound detected the presence of a testis in only 4/11 (36.3%) of patients, although it could not identify vanished testis.

**Conclusions** Initial laparoscopy should be retained as one of the standard treatment for nonpalpable testis. It was the only required modality in 26 patients (40%) and optimized further treatment in 39 patients (60%) by evaluation of the condition of the internal ring.

**Keywords** Laparoscopy · Nonpalpable testis · Orchiopexy

## Introduction

Cryptorchidism occurs in 3% of full-term boys [1], among whom nonpalpable testis is present in 20% [2]. Disagreements exist regarding the primary management of unilateral nonpalpable testis. Initial laparoscopy has been the mainstay of management and provides great accuracy [3–7]. Initial scrotal [8, 9] or inguinal [10, 11] incision followed by laparoscopy, either abdominal [10] or transinguinal [11], has also been reported, and each approach has its pros and cons. Herein, we present a review of our 8-year single-center experience of initial laparoscopy and an optimized approach for unilateral nonpalpable testis.

✉ Tarek Khalaf Fathelbab
tarekkhalaf86@yahoo.com

[1] Urology Department, School of Medicine, University Hospital, 61111 Minia, Egypt

## Patients and methods

We retrospectively evaluated all patients presenting to our institution with unilateral nonpalpable testis from June 2009 until August 2017. Seventy-four patients were included. To confirm the presence of nonpalpable testis, all the patients were subjected to careful examination by two independent senior staff. The use of warm lubricated hands increased the likelihood of palpation. The length of the contralateral testis was measured using a ruler.

We considered that compensatory hypertrophy was present when the length of the contralateral testis was ≥ 1.8 cm [12]. Preoperative imaging was not used during routine evaluation of nonpalpable testes. However, ultrasound results were available in 35 cases referred to our institute by pediatricians. Examination under anesthesia was performed for all patients. Nine patients proved to have palpable testes and were excluded from the study.

Initial laparoscopy was offered to all the remaining 65 patients.

## Surgical technique

Urethral catheterization and a nasogastric tube were used in all patients to decompress the bladder and stomach, and the patients were positioned in the Trendelenburg position (30°). The open Hasson technique [13] with a 5 mm port was used in all cases, and the pneumoperitoneum was adjusted so that it did not exceed 10 mmHg. Additional 5 mm ports were placed under vision to aid retraction if there was difficulty in visualizing the testis. Strict attention was paid to the position and condition of the testis, anatomical position, variation in spermatic vessels and vas deferens, and the patency of the internal ring. An optimized approach based on the laparoscopic findings was then followed.

## Results

Examination under anesthesia revealed that in 9/74 (12.2%) patients the testis was palpable, although it had been nonpalpable during the initial examination. These patients were omitted from the study and underwent inguinal orchiopexy. The remaining 65 patients were included in the study. The patients' ages ranged from 1 to 10 years (median age was 4 years). The right testis was nonpalpable in 23 cases (35.4%) and the left testis in 42 cases (64.6%).

Laparoscopy revealed the following findings: intra-abdominal testis in 18/65 (27.7%) patients, hypoplastic vessels and vas ending above the internal ring (blind-ending) in 8/65 (12.3%) patients, and vas and vessels traversing the internal ring in 39/65 (60%) patients. The laparoscopic findings are shown in Fig. 1. Of the 18 patients with an intra-abdominal testis, seven underwent Fowler–Stephens orchiopexy [14], nine underwent laparoscopic orchiopexy, and two underwent laparoscopic orchiectomy because of atrophic testes. In eight patients with blind-ending vas and vessels, laparoscopy was terminated.

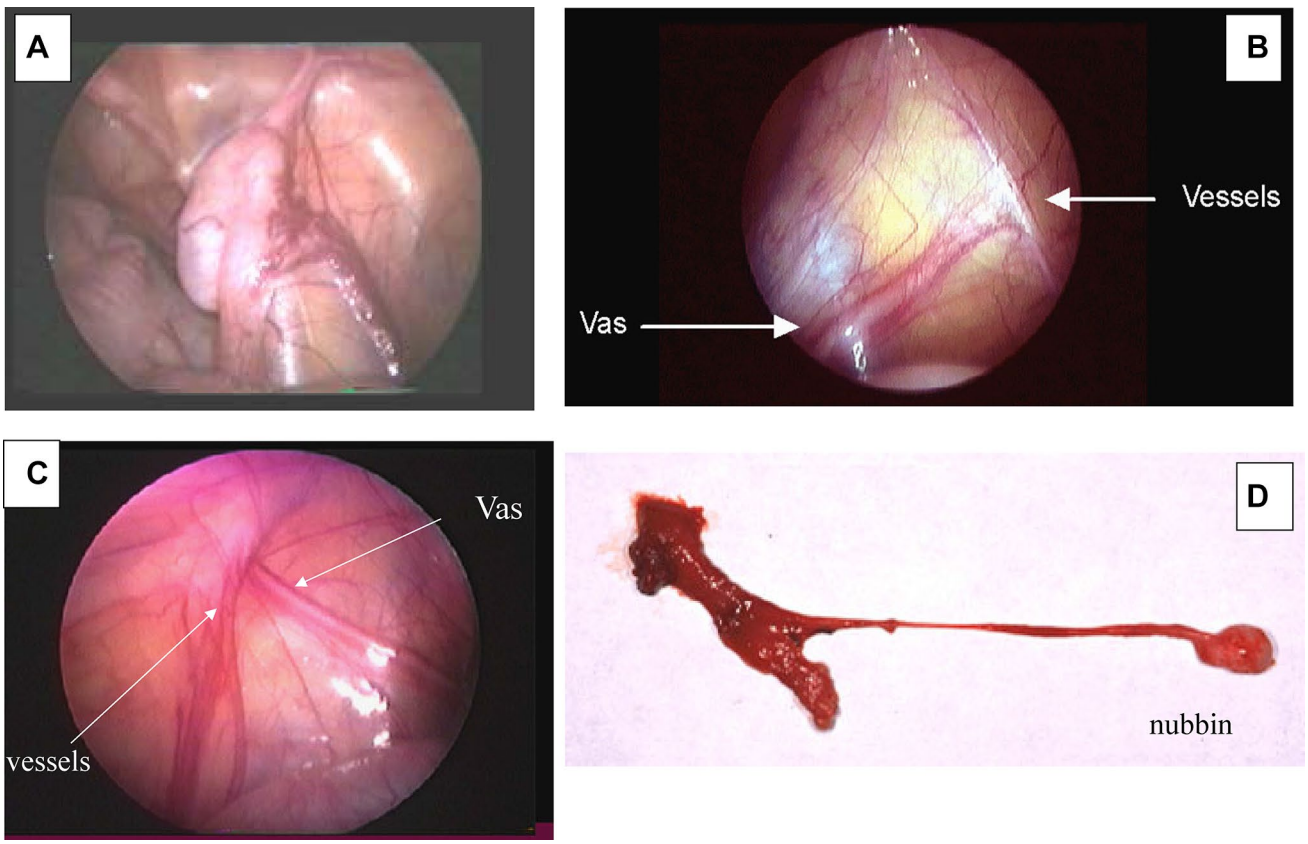


**Fig. 1** Laparoscopic findings in nonpalpable testis. **a** Intra-abdominal testis. **b** Blind-ending vas and vessel. **c** Vas and vessels traversing the internal ring. **d** Vanished testis

In 39 patients with vas and vessels traversing the internal ring, the choice between scrotal versus inguinal incision was made according to the condition of the internal ring. The internal ring was closed in 36 patients and open in three. All patients with a closed internal ring underwent an upper scrotal incision, and testicular reminants were found in 35/36 (97.2%) patients. The testicular reminants were present in the scrotum in 26 patients, in the external ring in eight, and in a low inguinal canal position in two. All reminants were excised and sent for histopathology. One patient (1/36, 2.8%) demonstrated an atrophic testis near the external ring and underwent orchiectomy. In the three patients with an open internal ring, inguinal exploration was performed and all underwent inguinal orchiopexy. Laparoscopy was the only diagnostic and therapeutic method used in 40% of patients, including those with an abdominal testis and blind-ending vas and vessels. An algorithm outlining our approach and the surgical findings is shown in Fig. 2.

Contralateral testicular hypertrophy with length ≥ 1.8 cm was confirmed during preoperative evaluation in 47 patients, in 43 (91.5%) of whom the vanished testis was present. Ultrasound results were available for 35 patients referred to our institute by pediatricians. Laparoscopic and/ or surgical exploration of these patients revealed the presence of the testes in 11 cases and the vanished testis in 24. Ultrasound detected the presence of a testis in only 4/11 (36.3%) of the patients, although it could not identify any cases of vanished testis.

## Discussion

Treatment of nonpalpable testis presents a challenge to urologists because of its variable etiology. However, the main treatment targets include orchiopexy for viable testis, confirmation of monorchism, and removal of any testicular reminants. These targets can be achieved through initial laparoscopy [3–7] or scrotal [8, 9] and inguinal [10, 11] explorations.

The first step in approaching boys with nonpalpable testis begins with a careful physical examination, which should be performed by an experienced urologist. Examination under anesthesia detects testes previously nonpalpable during office examination in 18–34% [15, 16]. Although obesity increases the difficulty of office examination, examination under anesthesia is an integral part of the evaluation of obese children with nonpalpable testis [17]. In the current study, 12.2% of patients proved to have a testis that was palpable after examination under anesthesia. This incidence is low in comparison with previous reports [15, 16], but this may be attributable to our protocol of validation of nonpalpable testis in the office by two independent senior staff.

Diagnostic imaging as an aid to localization of nonpalpable testis has been a matter of debate. In a recent review, Tasian et al. [18] reported that 34% of pediatricians included in their study frequently requested imaging, particularly ultrasound, before referring patients to a urologist. Although ultrasound is the most frequently used imaging modality, its calculated specificity and sensitivity for detecting

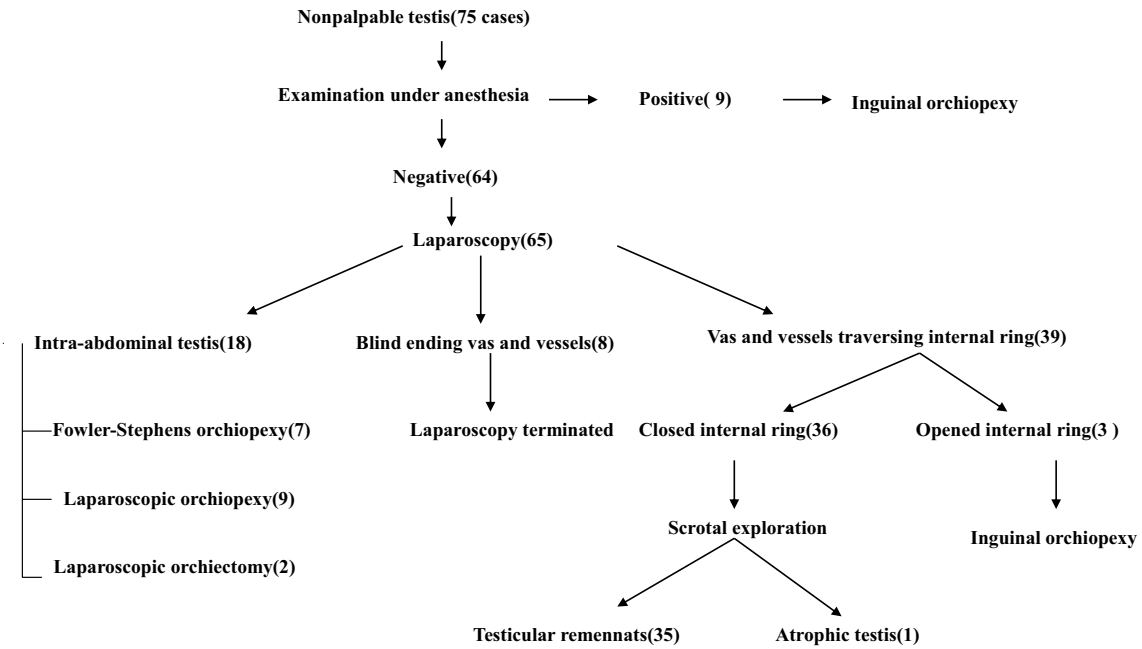


**Fig. 2** Algorithm outlining our approach and the surgical findings

nonpalpable testis are only 78% and 45%, respectively [19]. Although axial imaging methods such as Magnetic resonance imaging and computerized tomography may offer additional advantages over ultrasound, their use is limited by the need for sedation and the risks of radiation exposure [20, 21]. The current American Urological Association guidelines do not recommend preoperative imaging as an aid in cases of nonpalpable testis [22], and in our institute, we do not routinely use imaging to evaluate boys with nonpalpable testis. In the current study, ultrasound results were available for 35 patients who were referred to our institute by pediatricians. Correlation of the results of these ultrasounds with laparoscopic and surgical findings showed that ultrasound detected the presence of a testis in only 4/11 (36.3%) patients, while we were unable to diagnose any cases of vanished testis. These results are consistent with previous reports [19, 22].

The likely laparoscopic findings in cases of nonpalpable testis include intra-abdominal testis, blind-ending vas and vessels, and vas and vessels existing within the internal ring [3–7]. Intra-abdominal testis comprises 15–52% of cases [4–7, 23], blind-ending vas and vessels 9–22% [4–7, 23] and vas and vessels entering the internal ring 33–76% [4–7, 23]. In the present study, laparoscopy revealed intra-abdominal testis in 27.7% of patients, blind-ending vas and vessels in 12.3%, and vas and vessels traversing the internal ring in 60%, which compares favorably with previous reports [4–7, 23].

The patency of the internal ring is considered a good indicator of testis viability. Elder reported that when the internal ring is closed, 97% of nonpalpable testes will be absent or vanished [24]. Ueda et al. verified the concept that when there is a closed internal ring, vanished testis and a testicular reminant will be found in 100% of cases, regardless of the position of the vas and vessels [23]. In the present study, as previously mentioned, the condition of the internal ring was an integral factor in decision making and the choice of subsequent treatment [24]. A scrotal incision was performed in all patients who had vas and vessels traversing a closed internal ring: testicular reminants were found in 97.2% of patients. An inguinal incision was used in the three patients with an open internal ring, in whom inguinal orchiopexy was performed.

The vanished testis syndrome occurs mostly because of perinatal torsion, the location of which depends on the degree and extent of prenatal vascular events. It has been postulated that vanished testis occurs mostly in the scrotum [8, 9, 25]. However, this pathology can be extended to involve the spermatic cord, resulting in a blind-ending vas and vessels near the internal ring [3, 6, 7]. In the current study, vanished testis was diagnosed in 43/65 (66.1%) patients, comprising 12.3% intra-abdominal and 53.8% extra-abdominal vanished testis.

The presence of a scrotal nubbin associated with blind-ending vas and vessels above the internal ring deserves attention. Snodgrass et al. reported six cases of nubbins in conjunction with blind-ending vas and vessels [8]. Yamazaki et al. reported another variety of blind-ending vessels associated with a scrotal nubbin attached to the vas [26]. Ueda et al. reported that a scrotal nubbin is present in 100% of patients with vas and vessels traversing a closed internal ring, independent of the location of the vas and vessels [23]. In the current study, laparoscopy was terminated in patients with blind-ending vas and vessels, which is in agreement with other studies [3–7, 26]. A large prospective study including the pathology of retrieved specimens is needed to correlate the relationship between cases of blind-ending vas and vessels and the presence of a scrotal nubbin.

Contralateral testicular hypertrophy is a well-known condition associated with nonpalpable testis, mostly with monarchism [9, 12, 27, 28]. One possible explanation is abnormal hormonal secretion because of abnormal regulation of the hypothalamic pituitary pathway [29]. Koff reported that contralateral hypertrophy of $\geq 2$ cc volume or 2 cm length correlates with monarchism [27], while Hurwitz and Kapstein reported that testicular hypertrophy of 1.8 cm or more is more accurately correlated with monorchism in 93% of patients [12]. This was also supported by Snodgrass et al., who found that monorchism occurs in 88% of patients when the length of the contralateral testis is either $\geq 1.8$ cm or $\geq 2$ cm [9]. In a recent review, it was postulated that a contralateral testis length of 1.9–2 cm offers the best cut-off measurement correlating with monarchism [28]. In the current study, contralateral testicular hypertrophy with length $\geq 1.8$ cm was confirmed in 47 patients during preoperative evaluation; vanished testis was present in 43/47 (91.5%) of these patients. This was helpful in counseling the parents regarding their expectations of surgery.

Initial scrotal [8, 9] and inguinal [10] exploration for nonpalpable testis has been reported. The justification for this approach includes the fact that most of the patients in those series had a vanished testis that was present in a scrotal or inguinal position and could be treated easily through scrotal or inguinal incisions. Bae et al. reported that most of the cases of intra-abdominal testis in their series were peeping testes that could be brought through an inguinal incision; laparoscopy was needed in three cases of bilateral disease [10]. Similarly, Snodgrass et al. reported that laparoscopy was needed only when the scrotal findings were inconclusive as absent testis or patent processus vaginalis, and laparoscopy was performed in 23% of cases [9]. We think that in cases of nonpalpable testis, starting with initial scrotal or inguinal exploration creates a surgical dilemma. The diagnosis of nonpalpable testis on these occasions depends on visual inspection of the scrotal nubbin and the presence of a patent processus vaginalis, and/or extended inguinal exploration to confirm the diagnosis.

**Table 1** Laparoscopic findings and further action

| Laparoscopic findings | No | (%) | Further action |
|---|---|---|---|
| Intra-abdominal testis | 18 | 27.7 | Laparoscopic orchiopexy/orchectomy |
| Blind-ending vas and vessels | 8 | 2.3 | Laparoscopy terminated |
| Vas and vessels traversing the internal ring | 39 | 60 | Scrotal (36)/inguinal (3) exploration |
| Total | 65 | 100 | |

These maneuvers may be difficult to interpret and differentiate from one another [9, 10]. In addition, the report by Bae et al. [10] that most of the cases of intra-abdominal testis in their series were peeping testis and could be brought through an inguinal incision is unique. In the current study, all patients underwent initial laparoscopic exploration. Laparoscopy was the only diagnostic and therapeutic maneuver required in 40% of the patients, including those with abdominal testis and intra-abdominal vanished testis. In the remaining 60% of patients, laparoscopy was helpful in planning the subsequent treatment because it allowed observation of the internal ring. If the internal ring was closed, scrotal exploration was performed and testicular reminants were removed in 97.2% of patients. When an open internal ring was found, inguinal exploration was performed because it allows better high dissection of the processus vaginalis near the internal ring, and also allows extraperitoneal dissection and lengthening. This compares favorably with previous reports (Table 1) [3–7, 23].

## Conclusions

Initial laparoscopy should be retained as the standard treatment for nonpalpable testis. It was the only diagnostic and therapeutic modality required in 40% of patients in this study. In addition, further planning for the remaining 60% of patients can be facilitated through laparoscopy by evaluation of the condition of the internal ring.

### Compliance with ethical standards

**Conflict of interest** None of the contributing authors has any conflict of interest, including specific financial interests or relationships and affiliations relevant to the subject matter or materials discussed in the manuscript.

**Ethical approval** The study was approved by the Departmental ethics committee.

## References


1. Scorer CG (1964) The descent of the testis. Arch Dis Child 39:605–609
2. Acerini CL, Miles HL, Dunger DB, Ong KK, Hughes IA (2009) The descriptive epidemiology of congenital and acquired cryptorchidism in a UK infant cohort. Arch Dis Child 94:868–872
3. Moore RG, Peters CA, Bauer SB, Mandell J, Retik AB (1994) Laparoscopic evaluation of the nonpalpable tests: a prospective assessment of accuracy. J Urol 151:728–731
4. Radmayr C, Oswald J. Scwentner C, Neururer R, Peschel R, Barstsch G (2003) Long-term outcome of laparoscopically managed nonpalpabple testes. J Urol 170:2409–2411
5. Ismail K, Ashour M, El-Afifi M, Hashish A, El-Dosouky N, Nagm M et al (2009) Laparoscopy in the management of impalpable testis: series of 64 cases. World J Surg 33:1514–1519
6. Papparella A. Romano M, Novielle C, Cobellis G, Nino F, Monaco D et al (2010) The value of laproscopy in management of nonpalpable testis. J Pediatr Urol 6:550–554
7. Park H, Park YH, Park K, Choil H (2011) Diagnostic laparoscopy for the management of impalpable testes. Korean J Urol 52:355–358
8. Snodgrass WT, Chen K, Harrison C (2004) Initial scrotal incision for unilateral nonpalpable testis. J Urol 172:1742–1745
9. Snodgrass WT, Yucel S, Ziada A (2007) Scrotal exploration for unilateral nonpalpable testis. J Urol 178:1718–1721
10. Bae KH, Park JS, Jung HJ, Shin HS (2014) Inguinal approach for the management of unilateral non-palpable testis: is diagnostic laparoscopy necessary? J Pediatr Urol 10:233–236
11. Kenemoto K, Hayashi Y, Kojima Y, Tozawa K. Mogami T, Kohri K (2002) The management of nonpalpable testis with combined groin exploration and subsequent transinguinal laparoscopy. J Urol 167:674–676
12. Hurwitz RS, Kapten JS (2001) How well does contralateral testis hypertyrophy predect the absence of the nonpalpable testis? J Urol 165:588–592
13. Hasson HM (1971) A modified instrument and method for laparoscopy.Am. J Obstet Gynecol 110:886–887
14. Fowler R Jr, Stephens FD (1959) The role of testicular vascular anatomy in the salvage of high undescended testes. Aust N Zeal J Surg 29:92
15. Cisek LJ, Peters CA, Atala A, Bauer SB, Diamond DA, Retik AB (1998) Current findings in diagnostic laparoscopic evaluation of the nonpalpable testis. J Urol 160:1145–1149
16. Zakaria OM, Hokka E, El Kadi KE, Al Buali WH, Zakaria HM, Daoud MY et al (2013) Examination under anesthesia for management of impalpable undescended testis: A traditional technique revisited. World J Surg 37:1125–1129
17. Breyer BN, DiSandro M, Baskin LS, Hsieh MH (2009) Obesity does not decrease the accuracy of testicular examination in anesthetized boys with cryptorchidism. J Urol 18:830–834
18. Tasian GE, Yiee JH, Copp HL (2011) Imaging use and cryptorchidism: determinants of practice Patterns. J Urol 185:1882–1887
19. Tasian GE, Copp HL (2011) Diagnostic performance of ultrasound in nonpalpable cryptorchidism: a systematic review and meta-analysis. Pediatrics 127:119–128
20. Kantarci M, Doganay S, Yalcin A et al (2010) Diagnostic performance of diffusion-weighted MRI in the detection of nonpalpable undescended testes: comparison with conventional MRI and surgical findings. AJR Am J Roentgenol 195:W268–W273

21. Smith-Bindman R, Lipson J, Marcus R et al (2009) Radiation dose associated with common computed tomography examinations and the associated lifetime attributable risk of cancer. Arch Intern Med 169:2078–2086
22. Kolon TF, Herndon A, Baker LA, Baskin LS, Baxter CG, Cheng EY et al (2014) Evaluation and Treatment of Cryptorchidism: AUA Guideline. J urol 192:337–345
23. Ueda N, Shiroyanagi Y, Suzuki H, Kim WJ, Yamazaki Y, Tanaka Y (2013) The value of finding a closed internal ring on laparoscopy in unilateral nonpalpable testis. J Pediatr Surg 48:542–546
24. Elder JS (1994) Laparoscopy for impalpable testes: significance of the patent processus vaginalis. J Urol 1523:776–778
25. Belman AB, Rushton HG (2001) Is the vanished testis always a scrotal event? BJU Int 87:480–483
26. Yamazaki Y, Suzuki M, Shiroyanagi Y, Matsunol D, Tanaka Y (2009) Scrotal nubbins associated with blind-ending spermatic vessels and a normal vas deferens on laparoscopy. Int J Urol 16:902–904
27. Koff S (1991) Does compensatory testicular enlargement predict monorchism? J Urol 146:632–633
28. Braga LH, Kim S, Farrokhyar F, Lorenzi AJ (2014) Is there an optimal contralateral testicular cut- off size that predicts monorchism in boys with nonpalpable testicles? J Pediat Urol 14:693–698
29. Laron Z, Dickerman Z, Ritterman I (1980) Follow-up of boys with unilateral compensatory testicular hypertrophy. Fertil Steril 33:297–301