Published in final edited form as:

J Urol. 2009 February ; 181(2): 830–834. doi:10.1016/j.juro.2008.10.046.

Obesity Does Not Decrease the Accuracy of Testicular Examination in Anesthetized Boys With Cryptorchidism

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Abstract

Purpose—Given that the prevalence of childhood obesity is increasing in the United States, we tested the timely hypothesis that obesity hinders physical examination based localization of the cryptorchid testis.

Materials and Methods—Body mass index and percentiles of weight for height and body mass index for age were calculated for boys undergoing surgery for cryptorchidism at the University of California San Francisco Children's Hospital and Children's Hospital of Oakland. Two definitions of obesity were examined, ie greater than 85% or greater than 95% for either percentile. Patients were examined in the office and under general anesthesia before the skin incision. Intraoperative testicular location was recorded for each patient. The numbers of correct and incorrect preoperative determinations of testicular location were stratified by weight classification. Results were analyzed using contingency tables and Fisher's exact test.

Results—A total of 161 boys were recruited, accounting for 171 testes. The predictive value of palpating a suspected testis preoperatively with patients under anesthesia was greater than 95% for all weight classifications ($p < 0.0001$). The predictive value of not palpating a testis preoperatively under anesthesia was greater than 56% for obese boys and greater than 42% for nonobese boys ($p < 0.0001$). The concordance rates between examinations in the office and those performed under anesthesia were 90.9% and 82.7% for obese and nonobese boys, respectively ($p = 0.51$). The predictive value of not palpating a suspected cryptorchid testis in the office was higher in nonobese boys than in obese boys (81% vs 22%, $p < 0.0001$).

Conclusions—In our series childhood obesity did not make preoperative testicular examinations under anesthesia less accurate. However, office examinations may be more accurate in nonobese boys.

Keywords

body mass index; cryptorchidism; obesity; overweight; physical examination

Obesity has been identified by some surgeons as an impediment to successful palpation of the undescended testis or physical examination based determination of its absence.^{1,2} This is a contemporary concern given the increasing prevalence of obesity among American children of all age groups.^{3–5} We tested this hypothesis by reviewing our single institution experience with the accuracy of examining undescended testes in obese and nonobese boys.

MATERIALS AND METHODS

Patient Cohort

Our patient cohort was comprised of boys undergoing surgery for undescended testes at the University of California San Francisco Children's Hospital and Children's Hospital of Oakland. Patients were excluded from study if they had previously undergone inguinoscrotal surgery or radiological imaging that specifically identified or failed to identify the testis or testes in question. Patient data points including race, age, height and weight were recorded. Testicular examination was performed with patients under general anesthesia in the supine position at the time of orchiopexy and before the skin incision. All examinations were performed by 1 of 2 surgeons (LSB or MD). The surgeon who examined the patient in the office also performed any subsequent surgery.

Physical examinations were categorized by whether the examiner successfully or unsuccessfully palpated a testis. If the examiner believed that a testicular remnant was present, it was scored as a palpable testicle. Intraoperative testicular findings were noted for each patient, and stratified by whether the testis was 1) distal to the internal ring or 2) intra-abdominal or absent.

Surgical Algorithms

All patients underwent examination under anesthesia before determination of surgical approach. If the testis in question was not palpable, diagnostic laparoscopy was performed. If the undescended testis was palpable, an inguinal incision was made and orchiopexy was performed when possible. If the testis was consequently observed to be intra-abdominal, the inguinal incision was extended to allow performance of orchiopexy.

Definitions of Obesity

BMI was calculated for each patient, and percentiles of BMI for age and weight for height were determined based on definitions by the Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Overweight, National Center for Chronic Disease Prevention and Health Promotion. We applied the following definitions of childhood obesity. Patients were considered obese if 1) BMI for age or height for weight percentile was greater than 85% or 2) BMI for age or height for weight percentile was greater than 95%. The reference data sets for weight for length were assembled by the CDC based on the Missouri and Wisconsin Natality Data, and National Health and Nutrition Examination Survey I, II and III studies.^{4,6} The reference data sets for BMI for age were also constructed by the CDC and based on the National Health Examination Survey II and III, and National Health and Nutrition Examination Survey II and III studies.^{4,6}

Testicular Location Classification

A given preoperative testicular examination was scored as "correct" if the examiner declared the testis palpable and it was found distal to the internal ring, or if the examiner stated the testis was nonpalpable and it was found proximal to the ring or was absent. The number of correct and incorrect preoperative determinations of testicular location were logged and categorized by whether the patient was overweight or not overweight.

Statistical Analysis

The categorical variables of preoperative and intraoperative testicular location and weight classifications were analyzed with InStat® software, version 3 using contingency tables⁷ and Fisher's exact test. Two-sided p values less than 0.05 were considered significant.

RESULTS

Cohort Characteristics

A total of 161 boys were recruited for the study, representing 171 undescended testicles (tables 1 and 2). Of the patients 10 had bilateral cryptorchidism. Whereas boys above the 85th percentile of BMI for age or weight for height were older than those below the 85th percentile (mean 3.8 vs 2.9 years, $p = 0.038$), there were no statistically significant differences between obese and nonobese boys with regard to mean age ($p = 0.09$). A total of 97 boys (105 testes) had complete data available for comparisons of office examinations with examinations under anesthesia and intraoperative findings (tables 1 and 2).

Rate of Correct and Incorrect Testicular Examinations by Weight Classification

The predictive value of palpating a suspected cryptorchid testis was greater than 92% for all weight classifications, regardless of whether patients were awake or anesthetized (table 3). This outcome was essentially unchanged by excluding atrophic or ectopic testes.

The accuracy of not palpating suspected cryptorchid testes in anesthetized boys to predict intra-abdominal testes was lower, ranging from 42% (below 95th percentile of weight for height or BMI for age) to 53% (below 85th percentile), 56% (above 85th percentile) and 89% (above 95th percentile). Accuracy was more uniform when atrophic and ectopic testes were excluded from analysis (below 95th percentile 59%, below 85th percentile 63%, above 85th percentile 64% and above 95th percentile 69%). In short, accuracy was not decreased in obese boys. The accuracy of not palpating a suspected cryptorchid testis in awake nonobese boys (below 85th percentile of weight for height or BMI for age) was 72%, compared to 20% in awake obese boys (above 85th percentile). The predictive values of palpating or not palpating a purportedly cryptorchid testis in the office were not calculated for boys above the 95th percentile because of low sample size (total 13, with several categories having no patients). Office examinations and examinations under anesthesia were in agreement in 20 of 22 boys above the 85th percentile of BMI for age or weight for height, and in 62 of 75 boys below the 85th percentile ($p = 0.51$).

DISCUSSION

Obesity has been characterized anecdotally and in several studies as interfering with accurate examination of the cryptorchid testis.^{1,2} This issue is pertinent given the obesity epidemic among American children, and the fact that approximately 3% of all boys will have an undescended testis. We assessed this hypothesis by evaluating our single institution experience with the accuracy of examining undescended testes in obese and nonobese boys. To our knowledge this is the first study to examine the impact of obesity on the accuracy of testicular examination in children.

The perception that obesity makes accurate examination of the undescended testis difficult has been cited as part of the rationale for pre-orchiopey imaging and routine laparoscopy in boys with unclear testicular location.^{1,8} Although preoperative imaging will likely not prevent patients from requiring surgical exploration, it may help guide the decision of whether to start with inguinal vs laparoscopic exploration. In fact recent data suggest that preoperative ultrasonography in obese boys with unclear testicular location may help urologists choose the initial surgical approach.⁹ However, routine laparoscopy subjects a proportion of boys to additional time spent under anesthesia (albeit minimal), an extra incision, and the unlikely but real risks of access associated vascular and visceral injury.

In this series there was no significant decrease in accuracy of testicular examination between obese and nonobese boys placed under general anesthesia. Despite this finding, the

predictive value of not palpating a cryptorchid testis during office examination was higher for nonobese vs obese boys (greater than 72% vs less than 22%). We hypothesize that obesity in combination with muscle tone and resistance to examination by the awake child leads to decreased accuracy of testicular examination. Unfortunately we found that the predictive value of not palpating a suspected cryptorchid testis was relatively low (less than 82%) regardless of weight classification or setting of preoperative examination (in office or under anesthesia). Hence, we were unable to identify a subgroup of boys with nonpalpable testes in whom laparoscopy could be omitted.

Prior work has attempted to address the sensitivity and specificity of testicular examination under anesthesia. In particular bimanual digital rectal examination has been touted as a useful adjunct for detection of cryptorchid testes.¹⁰ The authors reported a physical examination specificity of 100%, sensitivity of 60% and positive predictive value of 100% when using bimanual techniques in boys under anesthesia. Interestingly the overall sensitivity of standard testicular examination (no bimanual technique) in our series was higher, at 76%. Hence, although such physical examination based techniques are appealing in principle, they do not appear to improve the predictive value of not palpating a suspected cryptorchid testis.

Our definition of obesity is a modification of the CDC definition. Specifically while the CDC strictly defines childhood obesity as a BMI for age above the 95th percentile, in our more liberal definition we grouped at risk boys (85th to 95th percentile) with obese boys. Furthermore, the CDC does not include weight for height percentiles in its definition of obesity, whereas we classified boys with weight for height percentiles of greater than 85 or greater than 95 as being obese. We chose to adapt the CDC definitions of childhood obesity to capture a broader definition of obesity (in the case of the more liberal definition), and to allow analysis of boys younger than 2 years, since BMIs for age percentiles are not available for this age group.

An obese adolescent may have a thicker abdominal wall than an obese toddler with a similar BMI for age. This finding could conceivably decrease the accuracy of examination for cryptorchid testes in older obese boys compared to younger ones. When we examined absolute overweight based on pure BMI rather than age adjusted percentiles there were no differences in the predictive value of palpable or nonpalpable testes between younger and older boys (data not shown). Hence, neither absolute nor relative adiposity decreased the accuracy of testicular examination.

BMI for age, although useful, is not a perfect predictor of obesity in children. However, this metric correlates well with other measures of adiposity, including dual energy x-ray absorptiometry and underwater weighing.¹¹ Another limitation of our study was the small patient cohort. Furthermore, the examinations were performed by 2 experienced pediatric urologists, and in less experienced hands obesity may cause more inaccuracy. Future studies are required to validate our findings.

CONCLUSIONS

In our series obese boys were not more prone to have erroneous preoperative testicular examinations under anesthesia. However, the predictive value of not palpating a cryptorchid testis in the awake child was higher in nonobese boys. Hence, although the doctrine that obesity contributes to inaccuracy in testicular examination should be reassessed in the setting of the operating room, it may still hold true in the office.

Abbreviations and Acronyms

BMI	body mass index
CDC	Centers for Disease Control and Prevention

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Table 1

	Overall	Percentile BMI for Age or Wt for Height		
		Above 85th	Below 85th	Above 95th Below 95th
No. suspected cryptorchidism:				
Unilat cases	151	47	104	34 117
Bilat cases	10	3	7	2 8
Total testes	171	53	118	38 133
Mean yrs age (range)	3.2 (2.6-3.8)	3.8(3.4-4.2)*	2.9(2.0-3.8)*	3.6(3.1-4.1) 3.1(2.5-3.7)
Mean kg/m ² BMI (range)	18.1 (17.5-18.7)	21.5 (20.2-22.8)	16.6 (16.2-17.0)	22.4 (21.9-23.0) 16.9 (16.5-17.3)
No. atrophic testes	13	3	10	2 11
No. ectopic testes	2	1	1	0 2
No. testes retractile under anesthesia	2	1	1	0 2
No. testes absent on exploration	2	2	0	2 0
No. cases with complete office/operative records	97	22	75	Not calculated [†] Not calculated [†]
No. suspected cryptorchidism + complete office/operative records:				
Unilat cases	89	20	69	
Bilat cases	8	2	6	Not calculated [†] Not calculated [†]
Total testes	105	24	81	

* Two-tailed t test $p = 0.038$.

[†] Indicated statistics were not stratified because of low number of patients in group above 95th percentile.

Table 2

	Overall	Percentile BMI for Age or Wt for Height			
		Above 85th	Below 85th	Above 95th	Below 95th
<i>No. preop anesthetized examination</i>					
Pts with palpable testes *	128	34	94	25	103
Pts with nonpalpable testes *	35	17	18	11	24
Palpable testes	131	35	96	27	104
Testes nonpalpable in office but palpable with anesthesia	40	18	22	11	29
<i>No. preop office examination</i>					
Pts with palpable testes	73	12	61	Not calculated [†]	Not calculated [†]
Pts with nonpalpable testes	24	10	14	Not calculated [†]	Not calculated [†]
Palpable testes	78	15	63	Not calculated [†]	Not calculated [†]
Testes nonpalpable with anesthesia but palpable in office	27	9	18	Not calculated [†]	Not calculated [†]

* Two patients had ipsilateral palpable testes and contralateral nonpalpable testes.

† Indicated statistics were not stratified because of low number of patients in group above 95th percentile.

Table 3

% Tests Palpable on Preop Anesthetized Examination		% Tests Not Palpable on Preop Anesthetized Examination		% Tests Palpable on Preop Office Examination		% Tests Not Palpable on Preop Office Examination	
Percentile BMI for Age or Wt for Height	Overall	Excluding Atrophic/Ectopic Testes	Overall	Excluding Atrophic/Ectopic Testes	Overall	Excluding Atrophic/Ectopic Testes	Overall
Above 85th:							
Intraop inguinoscrotal	97	97	44	36	93 [*]	100 [‡]	80 [*] 78 [‡]
Intraop intra-abdominal	3	3	56	64	7 [*]	0 [‡]	20 [*] 22 [‡]
Below 85th:							
Intraop inguinoscrotal	95	95	47	37	97	97	28 19
Intraop intra-abdominal	5	5	53	63	3	3	72 81
Above 95th:							
Intraop inguinoscrotal	97	97	11	31	Not calculated [‡]	Not calculated [‡]	Not calculated [‡]
Intraop intra-abdominal	3	3	89	69			
Below 95th:							
Intraop inguinoscrotal	95	95	58	41	Not calculated [‡]	Not calculated [‡]	Not calculated [‡]
Intraop intra-abdominal	5	5	42	59			

Values shown represent preoperative examinations corresponding to indicated intraoperative findings with p <0.0001 unless otherwise indicated.

^{*} p = 0.55.
[‡] p = 0.16.
[‡] Accuracy of preoperative office examinations is not listed because absolute number of examinations was low.