



Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jped surg

Disparities in pediatric gonadal torsion: Does gender, race and insurance status affect outcomes? ☆

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ARTICLE INFO

Article history:

Received 8 April 2017

Received in revised form 3 January 2018

Accepted 3 February 2018

Available online xxxx

Key words:

Ovarian torsion
 Testicular torsion
 Pediatric surgery
 Oophorectomy
 Orchiectomy
 Gender

ABSTRACT

Purpose: Ovarian and testicular torsions are emergencies requiring prompt surgical treatment to preserve gonadal function. However, diagnosis in females is often delayed owing to nonspecific symptoms. We sought to assess disparities in management and outcomes between males and females with torsion.

Methods: The National Inpatient Sample was queried for pediatric patients with “emergent”, “urgent”, or “trauma center” admission and ICD-9 codes for ovarian torsion and testicular torsion. Demographic data, operative procedure, gonadal loss, length of stay (LOS), total charges (TC), and mortality were recorded.

Results: There were 2254 unweighted encounters. The average age was 11.56 ± 5.30 years for males and 12.55 ± 3.72 years for females ($p < 0.001$). Among males, 90% underwent surgery ($p < 0.001$), of which 40% required orchiectomy. Conversely, 73% of females had surgery ($p < 0.001$), of which 78% had oophorectomy. Subsequent analysis with only patients who underwent surgery showed that insurance status ($p = 0.012$), race ($p < 0.001$), and U.S. region ($p < 0.001$) were significantly different between males and females. Gender specific analyses showed that hospital control, hospital location/teaching status, and treatment year were also significant. As such, these six factors in addition to age and gender were used for propensity score matching (PSM).

PSM produced two gender cohorts of 755 encounters each. Females had longer LOS (2.44 ± 1.84 days vs. 1.28 ± 2.27 days for males, $p < 0.001$) and had higher TC ($\$20,058.44 \pm 13,420.82$) compared to males ($\$12,386.58 \pm 12,793.34$), $p < 0.001$.

Logistic regression revealed that males (OR 0.163 [0.130–0.206]) and older patients (age OR 0.924 [0.903–0.946]) were less likely to undergo gonadal loss. Compared to those with private insurance, those with Medicare/Medicaid were more likely to have gonadal loss (1.401 [1.101–1.783]).

Conclusion: Disparities exist in the management of torsion based on gender. Overall, females had higher charges, had longer hospitalization, and were more likely to have gonadal loss despite current data supporting gonadal preservation for nearly all cases of ovarian torsion.

Clinical Study: Level III Evidence.

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Gonadal torsion is a true surgical emergency that requires a timely diagnosis and early surgical management. Clinical presentation can be nonspecific, especially in females, and requires a high index of suspicion. Prompt treatment is necessary to preserve gonadal function.

In the female pediatric population, ovarian torsion is a rare condition, and there is a significant amount of variation in the surgical management. Historically, ovarian torsion has been treated with prompt oophorectomy with concerns that the ischemic ovary could lead to

peritonitis or thromboembolism, or be harboring an underlying malignancy [1]. Recent literature has supported a more conservative treatment with detorsion and ovarian salvage [2–4].

In the male pediatric population, testicular torsion is more prevalent, and the intervention is less variable compared to females. Patients are urgently taken to surgery where the testes are examined. If torsion is encountered, the testes are detorsed and assessed for viability. If deemed viable, both testes are pexied, as there is an estimated 40% chance of torsion occurring metachronously in the contralateral testis [5]. If the testes are necrotic, or ischemic without improvement after detorsion, an orchiectomy is often performed.

There have been several studies comparing demographic factors contributing to the management of testicular torsion with conflicting results. Most published studies are small, retrospective reviews. There are little data on the epidemiologic factors and trends relating to the management of ovarian torsion.

☆ No external support or funding for this study. None of the authors have declared conflicts of interest.

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The objective of this study was to identify and assess trends and disparities in the surgical management and outcomes of both pediatric patients with gonadal torsion.

1. Methods

The National Inpatient Sample (NIS), part of databases developed for the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality was queried for pediatric patients (age < 18 years) with “emergent”, “urgent” or “trauma center” admission and ICD-9 codes for ovarian torsion (620.5) and testicular torsion (608.2, 608.20, 608.21, 608.22, 608.23, 608.24) between the years of 2005 and 2009. Those with ovarian torsion were further investigated to include those with diagnoses of ovarian pathology including follicular cysts (620.0), corpus luteum cyst or hematoma (620.1), other/unspecified ovarian cyst (620.2), prolapse or hernia of ovary/fallopian tube (620.4), malignant neoplasm of ovary (183.0) and benign neoplasm of ovary (220).

The NIS is the largest publicly available all-payer inpatient care database in the United States [6]. It approximates a 20% stratified sample of U.S. community hospitals by providing data from 1000 hospitals [6]. All discharges from the sampled hospitals are included in the database resulting in data from approximately 8 million hospital stays each year. This database also contains charge information on all patients, regardless of payer, including individuals covered by Medicare, Medicaid, private insurance and the uninsured.

Demographic data, operative repair, gonadal loss, length of stay (LOS), total charges (TC), and mortality were recorded. Operative procedures for males were defined as unilateral or bilateral orchiectomy (62.3, 62.4, 62.41, 62.42) with salvage operations being orchiopexy (62.5), and reduction of torsion of testis or spermatic cord (63.52). Operative procedures for females included oophorectomy or salpingo-

oophorectomy, whether unilateral or bilateral (65.3, 65.31, 65.39, 65.4, 65.41, 65.49, 65.5, 65.51, 65.52, 65.53, 65.54, 65.6, 65.61, 65.62, 65.63, 65.64). Gonadal preservation was the release of ovarian torsion (65.95). Cases with missing data were excluded.

Statistical analysis was done using IBM SPSS Statistics for Windows, Version 21.0 (Armonk, NY: IBM Corp.). Student’s t-test, chi-square test, and logistic regression were performed, where appropriate. Propensity score matching (PSM) using 1:1 nearest neighbor matching without replacement was implemented to evaluate endpoints that were found to be statistically significant on univariate analysis. A p-value < 0.05 was considered significant.

2. Results

There were 2254 unweighted encounters with no mortalities. The average age for males was 11.56 ± 5.30 years and 12.55 ± 3.72 years for females (p < 0.001). Among males, 90% underwent surgery (p < 0.001), of which 40% required orchiectomy. Conversely, 73% of females had surgery (p < 0.001), of which 78% had an oophorectomy. For females, only 3 (1%) of those who did not have surgery were transferred to another hospital for subsequent care. All surgical patients were managed at their respective hospitals and not transferred. When admission source was examined, 4.4% of males and 4.3% of females presented

Table 1
Patient characteristics comparing males and females in those who underwent surgery.

	MALES (n = 1051)	FEMALES (n = 794)	p-VALUE
AGE (YEARS)	11.94 ± 5.15	12.24 ± 3.89	0.158
INSURANCE STATUS (%)			0.012
Medicare/Medicaid	34.7	31.9	
Private	57.2	63.0	
Self-pay	8.1	5.1	
RACE (%)			<0.001
White	36.3	43.7	
Black	24.4	8.1	
Other	39.3	48.2	
HOSPITAL CONTROL (%)			0.125
Government or Private	77.0	73.3	
Government, nonfederal	3.9	5.1	
Private, not for profit	11.3	11.5	
Private, investor owned	6.2	7.0	
Private	1.6	3.2	
HOSPITAL LOCATION/TEACHING (%)			0.087
Rural	6.6	9.4	
Urban, nonteaching	29.2	27.7	
Urban, teaching	64.2	62.9	
HOSPITAL REGION (%)			<0.001
Northeast	38.4	27.6	
Midwest	14.5	19.6	
South	39.5	39.4	
West	7.6	13.4	
HOSPITAL BEDSIZE (%)			0.400
Small	12.2	14.3	
Medium	23.2	23.4	
Large	64.5	62.3	
YEAR (%)			0.226
2005	22.9	26.3	
2006	19.5	19.6	
2007	19.8	16.1	
2008	18.6	18.0	
2009	19.2	19.9	

Table 2
Comparison of ovarian loss versus salvage in females who underwent surgery.

	OVARIAN LOSS (n = 621)	OVARIAN SALVAGE (n = 173)	p-VALUE
AGE (YEARS)	12.31 ± 3.91	11.98 ± 3.81	0.319
INSURANCE STATUS (%)			0.058
Medicare/Medicaid	33.9	24.4	
Private	60.8	70.7	
Self-pay	5.2	4.9	
RACE (%)			0.196
White	48.6	46.8	
Black	42.5	48.0	
Other	8.9	5.2	
HOSPITAL CONTROL (%)			<0.001
Government or Private	70.0	85.0	
Government, nonfederal	5.8	2.3	
Private, not for profit	12.5	8.1	
Private, investor owned	8.6	1.2	
Private	3.1	3.5	
HOSPITAL LOCATION/TEACHING (%)			<0.001
Rural	10.4	5.8	
Urban, nonteaching	30.6	17.3	
Urban, teaching	59.0	76.9	
HOSPITAL REGION (%)			0.003
Northeast	24.6	38.2	
Midwest	21.3	13.9	
South	40.6	35.3	
West	13.5	12.7	
HOSPITAL BEDSIZE (%)			0.954
Small	14.3	14.5	
Medium	23.7	22.5	
Large	62.1	63.0	
YEAR (%)			0.880
2005	26.2	26.6	
2006	20.3	17.3	
2007	15.9	16.8	
2008	18.2	17.3	
2009	19.3	22.0	
LENGTH OF STAY (DAYS)	2.73 ± 1.88	1.82 ± 1.08	<0.001
TOTAL CHARGES (\$)	21,466.42 ± 15,183.75	17,997.43 ± 9853.19	<0.001

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