

Do Socioeconomic Factors Influence Testicular Salvage Rate in Pediatric Patients with Testicular Torsion? A Multi-campus Analysis within a Single Institution

✉ Jordan L. Mendelson¹, ✉ Diego R. Álvarez Vega², Thomas Chen³, Joo Lee¹, ✉ Katharine Hodgen¹, William Brenseke¹, Kaylee Bressler¹, Phillip Westbrook¹, Anand Rajan⁴, Grace Hyun⁵, ✉ Ronnie G. Fine^{1,2}, Mark Horowitz^{1,2}, Steven C. Friedman^{1,2}, Jaime Freyle^{1,2}, Jordan Gitlin^{1,2}

¹Department of Urology, New York University Langone Hospital-Long Island, Mineola, NY, USA

²New York University Grossman Long Island School of Medicine, Mineola, NY, USA

³SUNY Downstate College of Medicine, Brooklyn, NY, USA

⁴Biostatistics Core, Division of Health and Research, New York University Langone Hospital-Long Island, Mineola, NY, USA

⁵Department of Urology, New York University Langone Hospital-Brooklyn, Brooklyn, NY, USA

What's known on the subject? and What does the study add?

Prior studies have demonstrated conflicting findings regarding the impact of various socioeconomic variables on testicular salvage in cases of testicular torsion. While some have shown that one or more socioeconomic factors are independent predictors of testicular salvage, others have demonstrated the opposite to be true. In this study, we set out to determine whether clinical variables, campus location, or socioeconomic factors affected the testicular salvage rate among pediatric patients with acute testicular torsion.

Abstract

Objective: To determine whether any clinical variables, campus location, or socioeconomic factors affected testicular salvage rate in patients with acute testicular torsion.

Materials and Methods: We retrospectively reviewed all pediatric patients (age ≤ 18) with acute testicular torsion at one of three hospital campuses across one institution from October 2019-May 2024. Clinical data was collected and United States Census data was utilized to obtain socioeconomic data based on patients' zip codes. Orchiectomy and orchiopexy groups were compared using a Wilcoxon rank sum test and Fisher's exact test, as deemed appropriate. Generalized linear mixed-effect models with logistic link functions were then created to model the relationships between primary predictors of interest and testicular salvage. Results were considered significant at $p < 0.05$.

Results: Ninety seven total patients met inclusion criteria. Fifteen patients underwent orchiectomy; 82 underwent orchiopexy. Patients who underwent orchiectomy had significantly longer from symptom onset to emergency department (ED) presentation (48 hours vs. 4 hours, $p < 0.001$). There was no difference between the orchiectomy and orchiopexy groups in time from ED to operating room. Insurance status, median household income, education level, school enrollment, and employment status did not differ among the groups (all $p \geq 0.5$). Generalized linear mixed-effect models with logistic link functions revealed no significant predictors of testicular salvage rate.

Conclusion: Socioeconomic factors examined in this study were not significant predictors of testicular salvage in pediatric patients with acute testicular torsion. Patients who underwent orchiectomy took longer to present to the ED.

Keywords: Testicular torsion, emergency medicine, healthcare disparities, socioeconomic factors

Correspondence: Jordan L. Mendelson MD, Department of Urology, New York University Langone Hospital-Long Island, Mineola, NY, USA

E-mail: jordan.mendelson@nyulangone.org **ORCID-ID:** orcid.org/0000-0002-2814-9881

Received: 16.12.2025 **Accepted:** 04.03.2026 **Epub:** 19.10.2026

Cite this article as: Mendelson JL, Álvarez Vega DR, Chen T, Lee J, Hodgen K, Brenseke W, Bressler K, Westbrook P, Rajan A, Hyun G, Fine RG, Horowitz M, Friedman SC, Freyle J, Gitlin J. Do socioeconomic factors influence testicular salvage rate in pediatric patients with testicular torsion? A multi-campus analysis within a single institution. J Urol Surg. [Epub Ahead of Print]

©Copyright 2026 The Author(s). Published by Galenos Publishing House on behalf of the Society of Urological Surgery.

This is an open access article under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License.



Introduction

Acute testicular torsion (TT) in children is a urological emergency. Twisting of the spermatic cord leads to decreased arterial inflow to and venous outflow from the ipsilateral testicle, which may result in testicular infarction and subsequent loss of the testicle if not treated urgently. In the United States (U.S.), the estimated annual incidence of acute TT in males younger than 18 years is 3.8 per 100,000 (1). A proper is most often made via clinical exam and/or ultrasound (US) to confirm the absence of blood flow to the testicle. Following diagnosis, treatment consists of urgent surgical exploration, with either orchiopexy or orchiectomy performed depending on whether the testicle appears viable after detorsion. It has been demonstrated that irreversible testicular ischemia begins after six hours of TT (2). Prolonged ischemia creates a clear association between the time from symptom onset to treatment and the testicular salvage rate (i.e., orchiopexy rather than orchiectomy). One historical study found that orchiectomy was performed in only 4% of cases when TT was relieved within twelve hours of symptom onset, but in 75% of cases when surgical exploration occurred beyond this twelve-hour window (3). A more recent analysis of a national database found that orchiectomy was performed in 41.9% of boys undergoing surgery for TT overall (1). Although time from symptom onset to treatment or resolution of TT is generally accepted as a predictor of testicular viability and, therefore, testicular salvage, the literature remains unclear regarding additional factors that may influence salvage in the pediatric population with acute TT. Prior studies have demonstrated conflicting findings regarding the impact of specific socioeconomic variables (perhaps most notably, race and insurance status) on testicular salvage, possibly due in part to inherent differences among the populations studied. Some of these studies have shown that one or more socioeconomic factors are independent predictors of testicular salvage, while others have failed to demonstrate the same relationship. In this study, we set out to determine whether clinical variables, campus location, or socioeconomic factors affected the testicular salvage rate among pediatric patients with acute TT.

Materials and Methods

This study was deemed to not require ethics committee approval by our institution's IRB because it focused on disparities and quality improvement and lacked identifiable patient data. The attached IRB self-certification form demonstrates that this manuscript does not involve human subjects per our institution's own policy governing human subject research as well as federal regulations. We retrospectively reviewed all pediatric patients (age ≤ 18 years) who presented with acute TT

and subsequently underwent surgical exploration at one of three hospital campuses across one institution from October 2019-May 2024. Patients with neonatal TT were excluded from the study. All patients presented to the emergency department (ED) at one of the three hospital campuses and underwent a scrotal US, which definitively diagnosed acute TT by demonstrating absence of blood flow to the affected testis. During the specified time frame, no patients were transferred to any of these three hospital campuses for TT. Patients with intermittent testicular pain, with a presumed diagnosis of intermittent TT, were excluded from this study. No patients in the study had previously presented to the hospital complaining of testicular or scrotal pain. Patients transferred from another hospital to one of these three campuses were also excluded. Clinical data were collected on the following: time from symptom onset to presentation to the ED, time from ED presentation to the operating room, time from ED presentation to US order, time from surgical case request order to the operating room, hospital location, and testicular salvage rate. Time of symptom onset was defined from the patient's and family's own accounting and was extracted from chart review of each patient's admission history and physical. The time of ED presentation was defined as the time of the patient's first triage note in the ED. Demographic data were collected on age and health insurance status (i.e., Medicaid, private, self-pay/other). Data from the U.S. Census corresponding to patients' zip codes were then used to obtain additional demographic and socioeconomic variables, including total population, median household income, racial composition, employment status, primary language other than English, level of poverty, parental education level, and school enrollment.

Statistical Analysis

Patients were grouped based on whether they underwent orchiopexy or orchiectomy at the time of exploration. The primary outcome measure was the result of scrotal exploration: orchiopexy vs. orchiectomy. The two groups were compared using the Wilcoxon rank-sum test for continuous variables and Fisher's exact test for categorical variables. Generalized linear mixed-effects models with a logistic link were then created to model the relationships between the primary predictors of interest (i.e., time from symptom onset to ED presentation, time from ED presentation to operating room, and insurance status) and testicular salvage, while adjusting for potential population-level confounders from U.S. Census data and including a random effect for campus location. These models represented the secondary outcome measures of this study. All analyses were conducted using R Studio version 3.6.0. Results were considered significant at $p < 0.05$.

Results

A total of 97 patients met the inclusion criteria. The median age of all patients was 15.0 years. The median time from symptom onset to ED presentation was 5 hours. The median time from ED presentation to surgical exploration in the operating room was 197 minutes. Of these patients, 15 (15.5%) underwent orchiectomy and 82 (84.5%) underwent testicular salvage with orchiopexy. Notably, likely because US-confirmed TT was ubiquitous in this patient population, no cases of negative surgical exploration were observed. Patients who underwent orchiectomy had a significantly longer median time from symptom onset to ED presentation (48 hours vs. 4 hours, $p<0.001$). The two groups did not differ in median times from ED presentation to operating room ($p=0.6$), time from ED to US order ($p=0.2$), or time from surgical case request to operating room ($p=0.3$). No difference in salvage rates was observed across the three campuses ($p=0.4$). Age, insurance status, median household income, percentage of people living below the poverty line, percentage of people speaking a primary language other than English, parental education level, school enrollment, total population, and employment status were similar between the two groups (all $p\geq 0.3$). The overall median household income for the zip codes studied was approximately \$133,000, significantly higher than the ~\$80,000 median household income in the U.S. Similarly,

in the zip codes studied, the percentage of people with at least a Bachelor's degree was 48%, compared with approximately 38% across the U.S. These data demonstrate that our patient population was likely more affluent and better educated than the U.S. population at large. These results are summarized in Table 1. Generalized linear mixed-effects models with logistic link functions revealed that after adjusting for potential population-level confounders derived from U.S. Census data, time from symptom onset to ED presentation [odds ratio (OR): 0.99, $p=0.082$] (Figure 1), time from ED presentation to operating room (OR: 1.00, $p=0.572$) (Figure 2), and insurance status (OR: 0.92, $p=0.904$) (Figure 3) were not significant independent predictors of testicular salvage in this population.

Discussion

The impact of various clinical and socioeconomic factors on testicular salvage rate in pediatric patients with acute TT is still largely unknown. Whereas several studies have elucidated varying independent predictors of testicular salvage and/or orchiectomy, others have shown that these same variables are not significant predictors of outcomes in this patient population. One large, retrospective analysis of more than 2,200 patients from a national database found that, when TT in males and ovarian torsion in females were analyzed together, patients

Table 1. Clinical and socioeconomic characteristics of orchiectomy vs. orchiopexy groups

	Orchiectomy (n=15)	Orchiopexy (n=82)	p-value
Age (years)*	16.0 [11.0, 16.5]	14.0 [13.0, 16.0]	>0.9
Time from symptom onset to ED (hours)*	48 [20, 52]	4 [2, 13]	<0.001
Time from ED to operating room (mins)*	199 [169, 247]	193 [151, 232]	0.6
Time from ED to US order (mins)*	78 [45, 98]	56 [12, 92]	0.2
Time from case request to operating room (mins)*	63 [60, 75]	70 [57, 103]	0.3
Hospital location			
#1 (Urban)†	2 (13%)	10 (12%)	0.4
#2 (Suburban)†	7 (47%)	53 (65%)	
#3 (Urban)†	6 (40%)	19 (23%)	
Health insurance status			
Medicaid†	5 (33%)	23 (28%)	>0.9
Private†	8 (53%)	49 (60%)	
Self-pay/other†	2 (13%)	10 (12%)	
Household income (1,000\$)*	133.3 [73.8, 150.2]	135.1 [83.3, 152.7]	0.5
People below poverty line (%)*	12 [5, 18]	6 [4, 16]	0.4
Non-English primary language (%)*	45 [13, 49]	33 [15, 47]	0.4
People w/Bachelor's degree or above (%)*	48 [36, 54]	48 [31, 58]	>0.9
School enrollment (%)*	66 [60, 69]	68 [62, 69]	0.7
Total population (1,000 people)*	47.8 [33.9, 65.8]	42.0 [29.0, 61.9]	0.3
Employment (%)*	63 [59, 67]	63 [62, 65]	>0.9
*Median [interquartile range]. †n (%). ED: Emergency department, US: Ultrasound			

*Median [interquartile range], [†]n (%), ED: Emergency department, US: Ultrasound

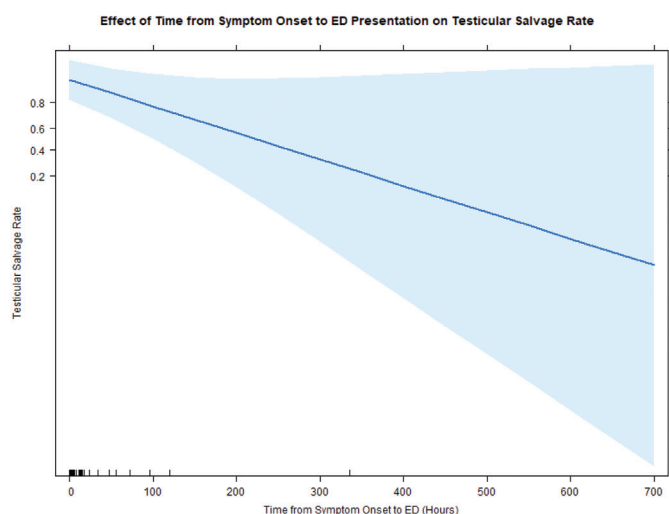


Figure 1. Graphical representation of mixed-effects logistic regression model demonstrating effect of time from symptom onset to ED presentation on testicular salvage rate. School enrollment, health insurance status, and primary language spoken at home were included in the model as covariates to adjust for socioeconomic characteristics. A random intercept for hospital location was also included to account for clustering of patients within hospitals
ED: Emergency department

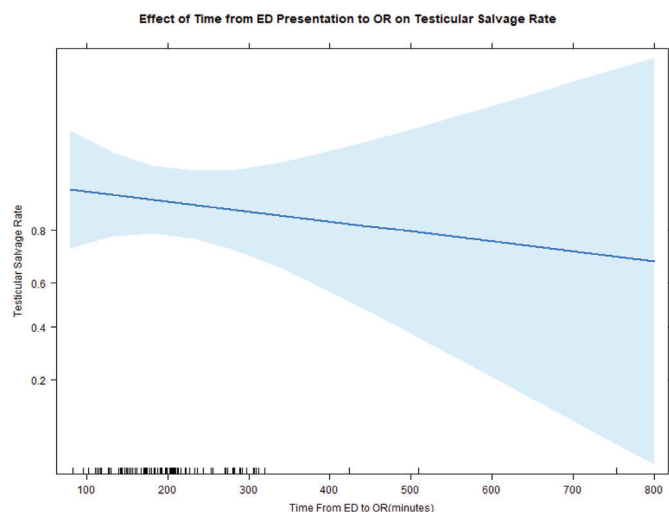


Figure 2. Graphical representation of mixed-effects logistic regression model demonstrating effect of time from ED presentation to OR on testicular salvage rate. School enrollment, health insurance status, and primary language spoken at home were included in the model as covariates to adjust for socioeconomic characteristics. A random intercept for hospital location was also included to account for clustering of patients within hospitals
ED: Emergency department, OR: Operating room

with Medicare/Medicaid were more likely to experience gonadal loss. This disparity was also observed when only males with TT were analyzed (4). The 40% overall rate of orchiectomy in that database analysis was similar to that demonstrated in prior studies (1,4-10). Similarly, Zhao et al. (1) found that Medicaid

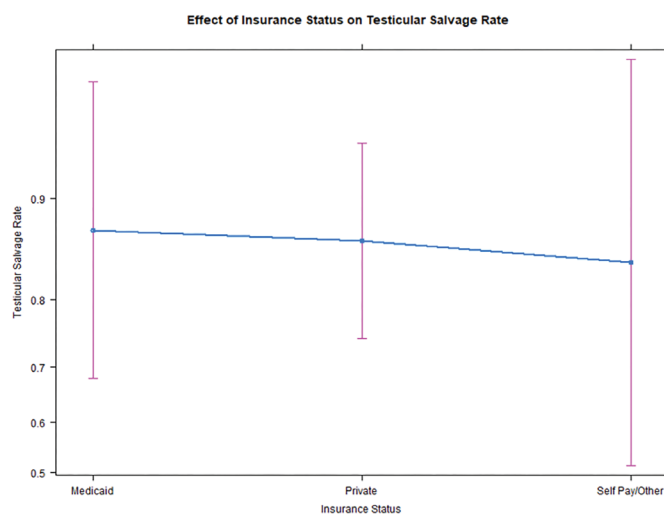


Figure 3. Graphical representation of mixed-effects logistic regression model demonstrating effect of insurance status on testicular salvage rate. Odds ratios for private insurance category and self-pay/other category were interpreted relative to Medicaid. School enrollment and primary language spoken at home were included in the model as covariates to adjust for socioeconomic characteristics. A random intercept for hospital location was also included to account for clustering of patients within hospitals

insurance independently predicted orchiectomy in his analyses of the the Healthcare Cost and Utilization Project Kids' Inpatient Databases for 2000, 2003, and 2006. Yet, his study demonstrated that Black race, an admission source other than the ED, and location at a designated children's hospital were independent predictors of orchiectomy and testicular loss (1).

While Cost et al. (7) and Lee et al. (5) both found that race is a predictor of orchiectomy, their findings were still discordant—whereas the former demonstrated that black children were more likely to undergo orchiectomy than their white counterparts, the latter determined that patients assigned to the heterogeneous “other” race category (i.e., non-Caucasian, non-Black, non-Hispanic/Latino) were more likely to undergo orchiectomy than patients in all of the aforementioned racial categories. Cost et al. (7), like Zhao et al. (1), found that insurance status is associated with a higher orchiectomy rate. Another analysis of more than 17,000 patients from a national database demonstrated that comorbidities and Medicaid insurance were independent predictors of orchiectomy (6). Yet several other studies have found no association between the aforementioned clinical or socioeconomic variables and testicular salvage rate in pediatric patients with acute TT (8-11). Four similar retrospective studies, encompassing single-center and multicenter designs, demonstrated that the only independent predictor of orchiectomy was the time from symptom onset to ED presentation (8-11).

Likewise, this study demonstrated a lack of clear predictive value for any of the clinical and socioeconomic variables analyzed.

Patients who underwent orchiectomy had a significantly longer median time from symptom onset to ED presentation. However, when models were subsequently created to adjust for potential confounding variables, this time interval was not an independent predictor of testicular loss. This discrepancy is likely related to a limited sample size for orchiectomy patients and, more broadly, to a relatively small study population, though it is also possible that this finding reflects collinearity with other variables. Expanding this study population would increase statistical power and thus the likelihood of detecting a statistically significant effect. The orchiopexy and orchiectomy groups were similar with regard to time from ED presentation to operating room, demonstrating that, regardless of the duration of symptoms prior to presentation, patients were taken to the operating room urgently within a similar time frame once diagnosed with acute TT. Likewise, campus location was not associated with variability in testicular salvage rates. All socioeconomic data retrieved from the U.S. Census were similar between the two groups. As such, this study adds to the growing literature showing a lack of universal evidence for disparate outcomes in this patient population based on various socioeconomic factors.

One of the primary strengths of this study is its multicenter design. The three hospital campuses of our institution included in this study encompass vastly different patient populations in both urban and suburban settings. This likely improves the study's external validity, given that the patients reported herein represent a fairly heterogeneous population. Despite this, the study population was shown to be more affluent and better educated than the U.S. population at large. This likely limits our ability to detect meaningful differences related to socioeconomic variables within the confines of this study and increases the risk of a type II error. The generalizability of these findings should be interpreted with caution. According to the U.S. Census Bureau, hospital #1 serves approximately 1.6 million people in an urban setting; hospital #2 serves approximately 1.4 million people in a suburban setting; and hospital #3 serves approximately 2.6 million people in an urban setting. Hospitals #1 and #3 are located in two of the most densely populated counties in the U.S. Each of these three hospitals is a large tertiary care center located in the northeastern U.S. The statistical methods and analyses in this study are also sound and help eliminate potential confounders.

Study Limitations

One of the limitations of this study is its retrospective design. However, no patients were excluded from our analyses once the inclusion criteria were met; that is, all patients ≤ 18 years of age who presented to the ED at one of the three campuses across our institution with acute TT and underwent surgical exploration

within the timeframe described were included within this study. The absence of specific exclusion criteria reduces potential bias arising from retrospective data selection. Another limitation is the small patient population studied; this is attributable to the low incidence of TT within the pediatric population at large.

Conclusion

In this retrospective multicenter study, Various clinical and socioeconomic factors were not significant independent predictors of testicular salvage in pediatric patients with acute TT. Patients who underwent orchiectomy presented to the ED later than patients who underwent testicular salvage with orchiopexy. In light of these findings, the authors recommend continuing to follow the general dogmatic practice for acute TT: prompt surgical exploration, in order to reduce testicular ischemia time and improve the likelihood of testicular salvage.

Ethics

Ethics Committee Approval: This retrospective study involved analysis of de-identified patient data collected as part of routine clinical care and as a related but separate component of a QI initiative within our institution. Informed consent was obtained from all patients or their legal guardians for the inclusion of their data into the study. Patient confidentiality was maintained throughout the data collection and analysis process. Furthermore, no identifiable patient information is included in this manuscript.

Informed Consent: Informed consent was obtained from all patients or their legal guardians for the inclusion of their data into the study. Patient confidentiality was maintained throughout the data collection and analysis process. Furthermore, no identifiable patient information is included in this manuscript.

Footnotes

Authorship Contributions

Surgical and Medical Practices: P.W., G.H., R.G.F., M.H., S.C.F., J.G., J.F., Concept: J.L.M., D.R.Á.V., J.G., Design: J.L.M., D.R.Á.V., T.C., J.G., Data Collection or Processing: J.L.M., D.R.Á.V., T.C., J.L., K.H., W.B., K.B., P.W., Analysis or Interpretation: K.B., A.R., Literature Search: J.L.M., D.R.Á.V., T.C., Writing: J.L.M., D.R.Á.V., K.H., W.B., K.B., A.R., G.H., R.G.F., M.H., S.C.F., J.G., J.F.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Zhao LC, Lautz TB, Meeks JJ, Maizels M. Pediatric testicular torsion epidemiology using a national database: incidence, risk of orchiectomy and possible measures toward improving the quality of care. *J Urol*. 2011;186:2009-2013. [\[Crossref\]](#)
2. Kapoor S. Testicular torsion: a race against time. *Int J Clin Pract*. 2008;62:821-827. [\[Crossref\]](#)
3. Anderson JB, Williamson RC. Testicular torsion in Bristol: a 25-year review. *Br J Surg*. 1988;75:988-992. [\[Crossref\]](#)
4. Buicko JL, Satahoo SS, Rao KA, Sola JE, Neville HL. Disparities in pediatric gonadal torsion: does gender, race and insurance status affect outcomes? *J Pediatr Surg*. 2018;53:1392-1395. Erratum in: *J Pediatr Surg*. 2019;54:618. Erratum in: *J Pediatr Surg*. 2020;55:779. [\[Crossref\]](#)
5. Lee AS, Pohl HG, Rushton HG, Rana MS, Davis TD. Do healthcare disparities play a role in pediatric testicular torsion? - Analysis of a single large pediatric center. *J Pediatr Urol*. 2022;18:210.e1-210.e7. [\[Crossref\]](#)
6. Sood A, Li H, Suson KD, Majumder K, Sedki M, Abdollah F, Sammon JD, Friedman A, Löppenber B, Lakshmanan Y, Trinh QD, Elder JS. Treatment patterns, testicular loss and disparities in inpatient surgical management of testicular torsion in boys: a population-based study 1998-2010. *BJU Int*. 2016;118:969-979. [\[Crossref\]](#)
7. Cost NG, Bush NC, Barber TD, Huang R, Baker LA. Pediatric testicular torsion: demographics of national orchiopexy versus orchiectomy rates. *J Urol*. 2011;185(6 Suppl):2459-2463. [\[Crossref\]](#)
8. Uppaluri C, Fischer K, Gaines T, Tan C, Lavelle J, Kaplan S, Godlewski K, Mittal S, Van Batavia J, Long C, Weiss D, Srinivasan A, Shukla A, Zaontz M, Zderic S, Kolon T. What matters in testicular torsion? Association of hospital transfer, race and socioeconomic factors with testicular outcomes in a single center experience. *J Pediatr Urol*. 2025;21:489-495. [\[Crossref\]](#)
9. Ramachandra P, Palazzi KL, Holmes NM, Marietti S. Factors influencing rate of testicular salvage in acute testicular torsion at a tertiary pediatric center. *West J Emerg Med*. 2015;16:190-194. [\[Crossref\]](#)
10. Zvizdic Z, Aganovic A, Milisic E, Jonuzi A, Zvizdic D, Vranic S. Duration of symptoms is the only predictor of testicular salvage following testicular torsion in children: a case-control study. *Am J Emerg Med*. 2021;41:197-200. [\[Crossref\]](#)
11. Stewart S, Briggs KB, Fraser JA, Osuchukwu OO, Roberts C, Oyetunji TA, Alemayehu H. Testicular torsion disparities in the pediatric population. *J Natl Med Assoc*. 2022;114:558-563. [\[Crossref\]](#)