

A Ten-Year Study on Risk Factors of Orchiectomy in Testicular Torsion

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Abstract

Testicular torsion is a common urological emergency among children, peaking in neonates and pubertal age with an incidence rate of 3.8 in 100.000 (0.004%) annually. This study aimed to explore the characteristics of testicular torsion cases and risk factors for orchiectomy in testicular torsion patients. This was a retrospective study on medical records of patients diagnosed with testicular torsion underwent surgery at the urology department of Dr. Hasan Sadikin General Hospital Bandung, Indonesia, from January 2009 to August 2019. Patient characteristics including age, duration of symptom, location, etiology, and degree of torsion were analyzed. A total of 86 cases of testicular torsion were identified, with most cases (54 cases, 62.8%) occurred at the mean age 14.67 ± 2.4 years old. Most patients (69 patients, 80.2 %) arrived more than six hours after the onset, and 65 (75.5%) and 4 (4.6%) of them underwent orchiectomy and orchidopexy, respectively. The remaining patients (17 patients, 19.8%) came less than 6 hours after the onset and only 8 (9.3%) and 9 (10.4%) underwent orchiectomy and orchidopexy, respectively. Both duration of torsion ($p = 0.000, P < 0.05$) and degree of torsion ($p = 0.006, P < 0.05$) were significantly correlated with orchiectomy. In conclusion, the risk factor for orchiectomy is strongly related to duration and degree of torsion. The chance for testis salvation increases if torsion happens before 4.5 hours and the degree of torsion is below 180 degrees. Prompt diagnosis and treatment is the only key to testicular salvation.

Keywords: Degree of torsion, torsion duration, testicular torsion

Introduction

Testicular torsion is a urological emergency with the peak incidence in neonates and pubertal age. The incidence rate is 3.8 cases among 100,000 people (0.004%) per year in males under 18 years old.¹ It also comprises up to 25% of acute scrotal disease in pediatrics.² Testicular torsion is a condition caused by excessive rotation of spermatic cord along a longitudinal axis which compromised the blood flow.^{2,3}

Twisting of the spermatic cord initially increases venous pressure and congestion, with a subsequent decrease in arterial blood flow and resulting in ischemia of testes.^{1,2,4} Ischemic condition of the testis will induce the inflammation process that leads to cell damage and make the patient start to feel pain.⁵⁻⁷ accounting for 9.7% (11/107 Scrotal wall

became reddish, swollen, and necrosis of the testis will likely occur in a couple of hours.^{1,8}

This condition needs quick and correct treatment to salvage the testis.⁹ The onset of the symptoms within 4 to 8 hours is often the most widely accepted window of treatment to preserve testicular function and avoid the need for orchiectomy. Salvage rate will be higher if surgical is performed before 6 hours of symptoms because testicular atrophy will occur by 6 to 8 hours, with necrosis ensuing within 8 to 10 hours of initial presentation.² It is believed that the salvage rate can reach 80-100% if the torsion is successfully repaired under 6 hours onset of symptom and 10% salvage rate if the torsion is repaired more than 24 hours onset of symptom.¹⁰

However, it is not unusual to see testicular necrosis with a short duration of symptoms, suggesting that the outcome of testicular torsion is not exclusively determined by the duration of ischemia. Another risk factor is the degree of rotation as it exerts a dose-dependent manner on organ damage. As the spermatic cord twist to a greater degree, there will be more occlusion

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and strangulation of testicular blood flow and resulting in more ischemia.^{4,11} Yet, Howe et al² found in a retrospective study that patients with onset of symptoms greater than 15 hours and 860 degrees of rotation still had salvage rate of approximately 50%.

Some studies also stated that age play role in determining the surgical outcome of testicular torsion. The report on this matter is still diverging on which group is at increased risk. Patients in the younger age group though to be at greater risk due to difficulties in communicating symptoms which may lead to inaccurate clinical diagnosis. On the other hand, others reported that older patients have worse outcomes because holding up to seek medical attention results in diagnostic delay.⁴

This research aims to find out the characteristic of testicular torsion cases and risk factors orchiectomy in testicular torsion patients. This study may contribute to the literature on the topic regarding testicular torsion in Indonesia.

Methods

This study is a retrospective study performed in urology department of Hasan Sadikin Academic Medical Center. The subjects were collected from medical of patients admitted to the urology department emergency room diagnosed with testicular torsion from January 2009 until August 2019. The inclusion criteria of this study were patients with a confirmed diagnosis of testicular torsion by surgical founding treated in Dr. Hasan Sadikin General Hospital during the study period. The demographic data were recorded during the study including age and duration of symptoms with a cut-off point of 6 hours. Other clinical variables collected during the study include the location (laterality), degree of rotation, etiology, and surgical management for each case. This study was conducted after obtaining approval from the Ethical Committee of Dr. Hasan Sadikin General Hospital (No LB.02.01/X.6.5/46/2021). Descriptive statistics were utilized to present the following data: age, duration of symptoms, location, a condition when torsion happened, degree of rotation, and management. Several aspects related to surgical outcome were analyzed using chi-square including ages, duration of torsion, location affected side, and degree of torsion. The p value < 0.05 denote the significance of the variable. The usage of chi-square test is to compare results in this study with the expected results. The significant

correlation was furthermore analyzed using multivariate analysis to find out how significant it was.

Results

There were 86 patients with testicular torsion treated during the study period. There were 5 children (5,8 %), 54 adolescents (62,8%), 26 adults (30,2%) and one elderly (1,2%) presented to the emergency room with testicular torsion. Most of the testicular torsion happened in adolescents aged 10-20 (mean 14,67±2,4, median 14) years old. The duration of symptoms was divided into 2 groups with a cutoff point of 6 hours. Seventeen patients (19,8%) came before 6 hours and most of the patients (69 peoples, 80,2%) arrived after more than 6 hours of symptoms duration. Based on the laterality of the affected side, 37 cases (41,9%) of testicular torsion was happening on the right side. Rest of the cases which happened on the left side account for 58,1% of cases (49 patients). Based on the condition when the symptom such as acute scrotal pain, nausea, and/or vomiting occurred, 15 patients (17,4%) felt that the symptoms were precipitated by the previous activity, 69 patients (80,2%) had complained of sudden onset of symptoms, and 2 patients (2,3%) had noted that their symptoms were precipitated by previous trauma. Twenty-two patients (25,6%) were found with a degree of rotation less than 360 degrees, 41 patients (47,7%) presented with a degree of rotation 360 to 720 degrees, and 23 patients (26,7%) came with rotation of more than 720 degrees. Surgical management for 73 patients (84,8%) had received orchiectomy and 13 patients (15,2%) had received orchidopexy. (Table 1).

The correlation of each factor described above with the surgical outcome was analyzed. P-value < 0,05 was used as significance variable. Both duration of torsion (p=0,000, p<0,05) and degree of torsion (p=0,006, p<0,05) were the two aspect significantly correlated with orchiectomy. Most patients (69 patients, 80,2%) who came after more than 6 hours of symptoms duration resulted in 65 (75,5%) orchiectomies. Meanwhile, from the degree of torsion perspective, most patients (41 patients, 47,7%) came with 360-720° (mean 372,9±46,9, median 360) of torsion. It resulted in 39 (45,3%) orchiectomy and 2 (2,32%) orchidopexy.

The multivariate analysis with logistic regression showed that duration and degree

Table 1 Patients Characteristics Comprised of Age, Duration, Location, Etiology, Degree of Torsion

Characteristics		Mean Median	Amount (people)	Orchiectomy	Orchidopexy	P Value
Age (years)	Total	17.56 ± 8 16	86	73 (84,8%)	13 (15,2%)	0,847 ^a
	0-1 Infant		0	0	0	
	1-10 Children	6±2.12 6	5 (5,8%)	4 (4,65%)	1 (1,2%)	
	10-20 Adolescent	14.67±2.44 14	54 (62,8%)	47 (54,7%)	7 (8,1%)	
	20-30	22.09±1.95 21.5		17 (19,7%)	5 (5,8%)	
	30-40 Adult	34±2.83 33	26 (30,2%)	4 (4,65%)	0	
	40-50			0	0	
	50-60			0	0	
	60-65			0	0	
	>65 Elderly		1 (1,2%)	1 (1,2%)	0	
Duration (hours)	0-6	4.29±1.31 4	17 (19,8%)	8 (9,3%)	9 (10,4%)	0,000 ^{a*}
	>6	111.9±156.8 72	69 (80,2%)	65 (75,5%)	4 (4,6%)	
Location	Right		37 (41,9%)	33 (38,3%)	4 (4,65%)	0,544 ^a
	Left		49 (58,1%)	40 (46,5%)	9 (10,45%)	
Etiology	During activity		15 (17,4%)	14 (16,2%)	1 (1,2%)	0,127 ^a
	Sudden		69 (80,2%)	61 (70,9%)	8 (9,3%)	
	Trauma		2 (2,3%)	1 (1,2%)	1 (1,2%)	
Degree of torsion	0-359°	184.3±19.6 180	22 (25,5%)	19 (22,09%)	3 (3,48%)	0,006 ^{a*}
	360-719°	372.9±46.9 360	41 (47,7%)	39 (45,3%)	2 (2,32%)	
	≥ 720°	720±0 720	23 (26,7%)	15 (17,4%)	8 (9,3%)	

a) Chi-square test; *statistically significant

of torsion have an R Square value of 69,5%. It means that those two factors contribute 69,5% as the risk factor orchiectomy in testicular torsion patients. Meanwhile, the other factors which contribute 30,5% to the risk factor

of orchiectomy were the variable which not included in this study and still needs further research (Table 2).

From 86 patients included in this study, the area under the curve (AUC) table and receiver

Table 2 Correlation of Duration and Degree of Torsion with Orchiectomy using Nagelkerke R Square Method

	Nagelkerke R	Exp (B)	95% CI.for Exp (B)	
	Square		Lower	Upper
Duration of torsion		0.980	0.963	0.998
Degree of torsion	69.5%	1.012	1.007	1.016
Constant		0.003		

operator curve (ROC) figure showed that the cutoff point for the duration of torsion is 4.5 hours with AUC 72.7% (CI 95%, CI: 0,594–0.860) and the cutoff point for degree of rotation is 184.5 degrees with AUC 88.2% (CI 95%, CI: 0,771–0,994) (Figure).

Discussion

Testicular torsion is an emergency condition in urology which spermatic cord twisted along a longitudinal axis causing a decrease in arterial blood flows then lead to ischemia of testes.¹⁻⁴ Many factors can contribute to testicular torsion such as congenital abnormality, abnormality of tunica vaginalis, testicular tumor, and some physical activity.^{12,13} Congenital conditions like an

abnormal connection between testis and adnexa and hypermobility of testis can cause testicular torsion. Swimming, weight lifting exercise, and skating were also believed contribute to testicular torsion.¹²

There are two type of testicular torsion, extra vaginal and intra vaginal torsion. Extra vaginal mostly occur in neonates, it happened because of epididymis, testis, and tunica vaginalis twist on spermatic cord. Intravaginal torsion mostly occur in adolescence, it is associated with the deformity of bell-clapper.¹⁴⁻¹⁶ Both of the type share the same pathophysiology which is decrease in arterial blood flow will resulted in ischemia of testes. The ischemic condition of testis lead the formation of reactive oxygen species (ROS) and induce recruitment of inflammatory cell that lead to cell damage.^{6,7}

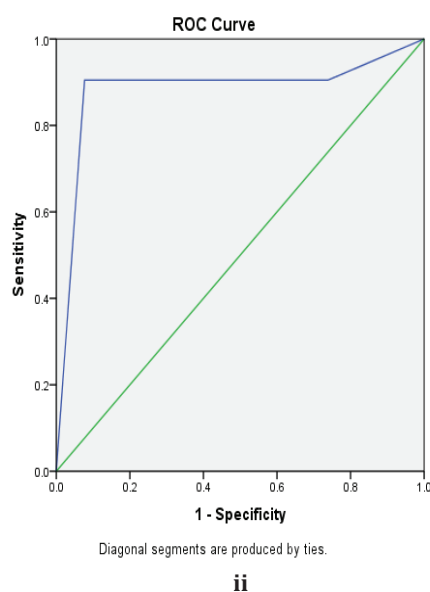
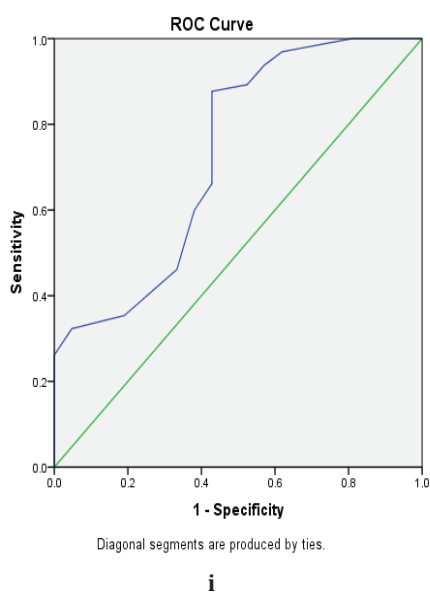


Figure ROC Curve

(i) Duration of torsion and (ii) degree of torsion in testicular torsion

The most prevalent sign of testicular torsion is sudden onset of continuous painful sensation at scrotal area.^{1,3} Lower abdominal pain can be the initial symptom in some patients.¹⁷ In some patients, the abdominal pain may be more prominent than scrotal pain, or without scrotal pain that leads to delayed diagnosis.¹⁸ It sometimes accompanied with gastrointestinal symptoms such as nausea and vomiting. Physical examination may reveal testes positioned higher and lie more transverse compared to normal which indicate twisted and foreshortened of the spermatic cord.¹ These initial findings in association with absence of cremasteric reflex are highly suggestive of testicular torsion.^{2,3}

The age distribution of testicular torsion is bimodal, with one peak in the neonatal period and the second peak around puberty.¹⁹ It comprises up to 25% of acute scrotal disease in pediatric.² Its incidence rate is 3.8 cases among 100.000 people (0.004%) per year in male under 18 years old.¹ Study conducted by Seppo et al²⁰ also shows that median age at operation in the detorsion group was 14 years (range 5–16) and in the orchiectomy group was 13 years (range 8–15) ($p=0,6$).²⁰ This study found that 62,8% (54 patients) of testicular torsion was happened in adolescent population, but the second peak of the case was happened in adult group (30,2%, 26 patients). Overall this research have the same conclusion with Howe et al.² that stated that testicular torsion can occur at any age, it is most commonly seen in the adolescent population.²

Testicular torsion is a rare but severe case because results in substantial tissue damage or even complete necrosis of the testicle.²⁰ Multiple studies have evaluated predictors of testicular salvage in testicular torsion, with variable results. Those studies tried to find out the existence of relationship between age, duration of ischemia, and amount of rotation with the surgical outcome.

There is disagreement about the role of age in the prognosis of testicular torsion. Patients in younger age group thought to be at greater risk due to difficulties in communicating symptoms which may lead to inaccurate clinical diagnosis.⁴ On the other hand, other reported that older patient (more than 40 years old) have worse outcome because holding up to seek medical attention resulting in diagnostic delay.⁴ The relationship between surgical outcome and age showed $p=0,847$. Therefore, in this study showed that age was not one of risk factor of orchiectomy in patients with testicular torsion.

The severity of torsion related to the duration

of symptoms. It was well known that duration of symptoms of less than 6 h was a significant predictor of testicular salvage.² Animal study using rats by Howe et al.² found poor histologic findings and decreased fertility rates starting at 3 hours of torsion and markedly decreased fertility rates after 9 hours.² Filho et al.⁴ also found correlation of torsion time and surgical outcome. Their study reviewed records of 117 patients with testicular torsion and found a median time of 8,4 hours in the salvageable groups. Reported testicular salvage rates are 90% to 100% if surgical exploration is performed within six hours of symptom onset, decrease to 50% if symptoms are present for more than 12 hours, and are typically less than 10% if symptom duration is 24 hours or more. Study by Filho et al.⁴ asserted that there is no absolute time beyond which one can assume that infarction is inevitable. In his study, one organ was found necrotic after only 4 hours of ischemia, and 2 testicles were viable after 25 days of symptoms.

Contribution of degree of torsion was showed in this study. The R square value for duration and degree of torsion was 69,5%. It means that those two factors contribute two third and also became the major factor as the risk factor orchiectomy in testicular torsion patient. Contribution of degree of torsion on testis salvation also showed in an experimental study which showed that 3 or 4 complete turns produce irreversible ischemic changes as early as 2 hours, whereas one turn can be tolerated for 12 hours, even though infarction inevitably occurs after 24 hours.⁴ Filho et al⁴ also found that testes were salvaged in all patients less than 360 degrees and removed in all patients over 1,080 degrees of twisting.

Severe atrophy has been observed after 4 hours of torsion when the turn on the cord is more than 360 degrees.^{3,4} Therefore the number of torsion exert multiplicative effect on ischemia time. It acts on dose dependent manner, more degree of rotation will cause in more vascular occlusion and result in more ischemia.^{3,4} This study found that duration and degree of torsion were two major risk factors for orchiectomy. It also revealed that chance of salvation was 72,7% if surgery perform before 4.5 hours of symptoms duration and 88,2% if degree of rotation less than 184.5 degrees.

Testicular torsion mostly happened in males at pubertal age. Most patients came after 6 hours of duration and surgical finding found the degree of torsion was more than 360 degrees. The risk factor for orchiectomy is strongly related to the duration and degree of torsion. The chance for

testis salvation increased if torsion happened before 4.5 hours and the degree of torsion was below 180 degrees. Degrees of torsion is something that cannot be manipulated. The chance of testis salvation is dependent on correct diagnosis dan prompt surgical intervention to decrease the duration of ischemia.

This study has a total of 86 subjects and a 10-year duration of the study. These are the superiority compared to previous studies in the number of subjects and duration of the study. The limitation of this study is AUC of the duration of torsion is only 72.7%.

In conclusions, the risk factor for orchiectomy is strongly related to duration and degree of torsion. The chance for testis salvation increased if torsion happened before 4,5 hours and the degree of torsion was below 180 degrees. Prompt diagnosis and treatment is the only key to testicular salvation.

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