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# Timing and outcomes of testicular torsion during the COVID-19 crisis



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## Summary

### Background

During the COVID-19 crisis, there has been widespread reporting that non-COVID-19-related medical care has been delayed, even for emergent conditions. Testicular torsion is an emergent condition with higher risk of testicular loss with longer ischemic times. We sought to investigate whether patients with testicular torsion had longer time from symptom onset to initial presentation, longer total ischemic time, and higher rate of orchiectomy during the pandemic.

### Materials and methods

Using billing data, we identified all patients age >1yo seen in our hospital from 1/1/2018 through 5/31/2020 who underwent emergent scrotal exploration for confirmed testicular torsion, comparing the COVID-19 crisis (3/1/2020–5/31/20) to the pre-COVID-19 period (1/1/2018–2/29/20). The primary outcome was time from symptom onset to initial presentation and secondary outcomes were ischemic time (time from symptom onset to entry of the OR) and orchiectomy rate. Parameters were compared with Mann–Whitney U and Fisher's exact tests; Poisson regression compared rates of torsion.

### Results

Of 94 total cases, 77 occurred during the pre-COVID-19 period and 17 during the COVID-19 crisis. Median

time from symptom onset to initial presentation was not significantly different (2.4 h [IQR 1.1 h–38.9] during COVID-19 vs. 5.6 h [IQR 1.6–16.9] during pre-COVID-19 period,  $p = 0.476$ ). Time to presentation was >12 h in 5/17 patients (29%) during COVID-19 and 24/77 patients (31%) during pre-COVID-19 period ( $p = 1.00$ ). Median ischemic time during COVID-19 was 7.5 h (IQR 4.7 h–45.5 h) compared to 9.4 h (IQR 5.4 h–22.5 h) during pre-COVID-19 period ( $p = 0.694$ ). Incidence of orchiectomy in our center was 29% (5/17) during COVID-19 and 17% (13/77) during pre-COVID-19 period ( $p = 0.397$ ). About half of patients were seen initially at outside facilities prior to arrival (47% [8/17] during COVID-19 vs. 49% [38/77] during pre-COVID-19 period,  $p = 1.00$ ). The number of torsion case presentations per week to our facility increased from 0.7 cases/week in the pre-COVID-19 period to 1.3 cases/week during COVID-19 ( $p = 0.015$ ); when comparing only the March 1 to May 31 calendar period, there were 0.6 cases/week during the pre-COVID-19 period and 1.3 cases/week during COVID-19 ( $p = 0.021$ ).

### Conclusion

Time to presentation, ischemic times, and orchiectomy rates for testicular torsion at our center were not significantly different during the COVID-19 period compared to the preceding 2 year period. The number of torsion case per week presenting to our facility increased significantly.

**Summary Table 1** Comparison of patients, timing, and testicular outcomes among patients with testicular torsion before and during COVID-19 crisis.

	Overall	Pre-COVID	COVID	p-value
n	94	77	17	
Age, years (median [IQR]{range})	14.38 [12.70, 15.87] {1.3–19.7}	14.22 [12.64, 15.83] {1.3–19.7}	15.24 [14.21, 16.01] {4.2–17.4}	0.2950
Time from symptom onset to presentation, hours (median [IQR]{range})	5.38 [1.49, 18.38] {0.7, 148.0}	5.58 [1.60, 16.85] {0.7, 81.3}	2.40 [1.12, 38.92] {0.9, 148.0}	0.4760
Time from symptom onset to presentation > 6 h, n (%)	43 (45.7)	35 (45.5)	8 (47.1)	1.0000
Time from symptom onset to presentation > 12 h, n (%)	29 (30.9)	24 (31.2)	5 (29.4)	1.0000
Ischemic time, hours (Time from symptom onset to OR) (median [IQR]{range})	9.19 [5.32, 26.02] {2.7, 152.2}	9.40 [5.42, 22.52] {2.7, 86.3}	7.52 [4.67, 45.45] {2.7, 152.2}	0.6940
Orchiectomy, n (%)	18 (19.1)	13 (16.9)	5 (29.4)	0.3970
Presentation at OSH, n (%)	46 (48.9)	38 (49.4)	8 (47.1)	1.0000

## Background

The COVID-19 crisis has impacted all aspects of life. Lockdowns and social distancing have limited normal interactions and activities, and many elements of the medical system have been temporarily shut down or operated with severely limited access during the pandemic [1,2]. Emergency services have likewise been affected, and there has been widespread reporting that non-COVID-19-related medical care has been delayed as people avoid presenting to medical facilities due to concern about the coronavirus [3]. Some reports have noted prolonged delays for even emergent life-threatening conditions such as myocardial infarction and stroke [4,5].

Testicular torsion is a surgical emergency with organ loss being the end result of the untreated condition. It has long been recognized that there is a higher risk of testicular loss, atrophy, and dysfunction with longer ischemic times [6]. Many factors contribute to delays in presentation for torsion and such delays may impact outcomes. Efforts have been made in recent years to implement quality and process improvements to reduce ischemic time in the torsion population [7,8], with limited effectiveness. Given the difficulty and high testis loss rate even under optimal conditions, there is reason to be concerned that the COVID-19 pandemic might negatively impact presentations for acute scrotum.

We sought to determine if timing and outcomes of patients with testicular torsion presenting to our hospital changed during the pandemic compared to historical norms. We hypothesized that since the start of the COVID-19 crisis in our region, patients with testicular torsion had longer time from symptom onset to initial presentation, longer total ischemic time, and higher rate of orchiectomy.

## Methods

Using hospital billing data, we identified all patients seen in our hospital with diagnosis codes for testis torsion. The included time period was 1/1/2018 through 5/31/2020. The initial search was for all patients seen in any part of our

facility with one of the following ICD-10 diagnosis codes: N44.00 (Torsion of testis, unspecified), N44.01 (Extravaginal torsion of spermatic cord), N44.02 (Intravaginal torsion of spermatic cord), N44.03 (Torsion of appendix testis), or N44.04 (torsion of appendix epididymis). From this list, we then identified all patients who underwent surgical treatment during the encounter, and emergency department, consult, and operative notes were reviewed to confirm that the diagnosis at surgery was acute testicular (spermatic cord) torsion. Infant torsion cases (age < 1 year), torsion of undescended testes, elective procedures for suspected cases of intermittent torsion, and cases of torsed appendices were excluded.

We compared cases presenting during the initial phase of the COVID-19 crisis (1 March 2020–31 May 2020) to those presenting during the pre-COVID-19 period (1 January 2018–29 February 2020). In our region, isolated cases of COVID-19 occurred in late February 2020, and began increasing exponentially during the first week of March 2020, and the state closed schools and businesses as of 15 March 2020 [9]. Recognition of the developing pandemic and coverage of early local cases was widespread in the press from the start of March 2020. Elective surgery at our hospital was suspended 16 March 2020 based on state requirements. Emergent surgeries were not restricted and although all patients were tested for COVID-19, results were not typically back soon enough for immediate action, so N95 masks were worn and all other proper precautions were taken. Peak infections in our state occurred in late April and Phase 1 reopening was initiated on May 18th. At our peak our state had over 2500 daily new cases and greater than 150 daily deaths [9]. Therefore, we elected to consider 1 March 2020 as the start of the COVID-19 period, and included the following 3 months as the pandemic period. For comparison we collected data from the preceding 26 months. Our metropolitan statistical area serves 4.8 million people.

The primary outcome was time from symptom onset to initial presentation at any emergency care facility (ours or outside facility) based on history from the patient and family. Time was analyzed as a continuous variable, as well

as above or below clinically-significant cutoffs of 6 h and 12 h [10]. If the patient presented initially to a non-surgical facility (e.g. the pediatrician’s office), this was not counted as the time of presentation; only after they reached a facility with surgical capability (e.g. emergency department at a hospital with surgical facilities) did we consider that they had presented for time measurement purposes. Our center has a longstanding ED algorithm for testicular pain so that the management pathway once a patient presented to the ED would have been reasonably constant both before and during COVID-19. As part of our Department’s Quality Improvement program, we have prospectively tracked torsion presentation parameters (including time of onset of symptoms) for several years. We used these data as a starting point, and then performed detailed chart review to confirm timing of key events in the history, including onset of symptoms and initial presentation to an outside emergency facility (if any). Time of arrival at our facility and time at entry to the OR were recorded from the hospital electronic record. Secondary outcomes included total ischemic time (time from symptom onset to entry of the OR), and orchiectomy rate. We further examined referral practice patterns, such as whether there were changes in the proportion of patients who presented to outside emergency facilities before being transferred to our facility. Lastly, we examined number of torsion cases per week presenting to our facility during both pre-COVID-19 and COVID-19 periods.

Mann–Whitney U and Fisher’s exact tests were used to compare continuous and categorical variables between the time periods, respectively. Poisson regression was used to examine number of torsion per cases per week during the time periods. Data was examined for autocorrelation. This study was submitted to the IRB (protocol number P00034709) and was deemed exempt.

**Results**

During the study period, we identified a total of 94 cases of acute testicular torsion among boys greater than 12 months of age (age range: 1.3–19.7 years). Of these, 77 occurred during the pre-COVID-19 period and 17 during COVID-19

(Table 1). Median time from symptom onset to initial presentation was not significantly different during the pandemic (2.4 h (IQR 1.1–38.9) during COVID-19 vs. 5.6 h (IQR 1.6–16.9) during the pre-COVID-19 period,  $p = 0.476$ ). Time from symptom onset to initial presentation was >6 h in 8/17 patients (47%) during COVID-19 and > 6 h in 35/77 patients (46%) during pre-COVID-19 period ( $p = 1.00$ ). Time to presentation was >12 h in 5/17 patients (29%) during COVID-19 compared to 24/77 patients (31%) during pre-COVID-19 period ( $p = 1.00$ ). There were examples of patients presenting with extreme delay in both time periods; two patients during the COVID-19 period had times to presentation (124.0 h and 148.0 h) greater than the maximum time to presentation (81.4 h) observed during the pre-COVID-19 period.

Median ischemic time (time from symptom onset to entry to the OR) during COVID-19 was 7.5 h (IQR 4.7–45.5) compared to 9.4 h (IQR 5.4–22.5) during the pre-COVID-19 period ( $p = 0.694$ ). Incidence of orchiectomy also was not significantly different between time periods, with 29% (5/17) undergoing orchiectomy during COVID-19 and 17% (13/77) undergoing orchiectomy during the pre-COVID-19 period ( $p = 0.397$ ).

To account for possible seasonality in the results, we also compared the primary and secondary outcomes during the 1 March to 31 May calendar block, during pre-COVID-19 (15 cases) and COVID-19 (17 cases). There was no significant difference in time from symptom onset to presentation ( $p = 0.9681$ ), cases with time to presentation > 6 h ( $p = 0.4651$ ), cases with time to presentation > 12 h ( $p = 0.6911$ ), ischemic time ( $p = 1.00$ ), or incidence of orchiectomy ( $p = 0.4025$ ).

Presentation trends were similar in both time periods: 47% (8/17) of patients were seen initially at an outside emergency facility during COVID-19, vs. 49% (38/77) of patients during the pre-COVID-19 period ( $p = 1.00$ ). Of note, ischemic times among patients in both time periods were slightly longer for patients who were seen initially at an outside facility; median ischemic time was 8.9 h (IQR:3.9–17.2) among those NOT seen at another facility prior to arrival at our facility, versus 9.6 h (IQR: 5.8–35.9)

**Table 1** Comparison of patients, timing, and testicular outcomes among patients with testicular torsion before and during COVID-19 crisis. (P-value for Mann–Whitney U test or Fisher’s exact test).

	Overall	Pre-COVID	COVID	p-value
n	94	77	17	
Age, years (median [IQR]{range})	14.38 [12.70, 15.87] {1.3–19.7}	14.22 [12.64, 15.83] {1.3–19.7}	15.24 [14.21, 16.01] {4.2–17.4}	0.2950
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Time from symptom onset to presentation > 6 h, n (%)	43 (45.7)	35 (45.5)	8 (47.1)	1.0000
Time from symptom onset to presentation > 12 h, n (%)	29 (30.9)	24 (31.2)	5 (29.4)	1.0000
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Orchiectomy, n (%)	18 (19.1)	13 (16.9)	5 (29.4)	0.3970
Presentation at OSH, n (%)	46 (48.9)	38 (49.4)	8 (47.1)	1.0000

among those who WERE seen at another facility ( $p = 0.042$ ).

We also examined the number of torsion cases per week that presented to our facility during the respective time periods (range: 0–5 cases in a given 7 day period). The number of torsion cases increased by 92% (95CI: 22–201%,  $p = 0.015$ ), from 0.7 cases/week during the pre-COVID-19 period (1/1/18–2/29/20, 112.7 weeks) to 1.3 cases/week during COVID-19 (3/1/20–5/31/20, 13 weeks). To further adjust for possible seasonal variation, we limited the analysis to the 3 month calendar period during COVID-19 (March 1–May 31, or 13 weeks) and compared it to the same calendar periods in 2018 and 2019. In this sub-analysis we found that there were 10 cases in 2018, 5 cases in 2019, and 17 cases in 2020, equating to 0.6 cases/week during the pre-COVID-19 period and 1.3 cases/week during COVID-19, with cases during COVID-19 increasing by 126% (95% CI: 12–357%,  $p = 0.021$ ).

## Discussion

In this study we compared presentation trends and outcomes among boys with testicular torsion at our facility before and during the COVID-19 crisis. Contrary to our expectations and hypothesis, we found no significant differences between the pre-COVID-19 and COVID-19 periods in time to presentation, ischemic time, orchiectomy rates, or referral patterns for testicular torsion. We did see significantly more torsion cases per week during the pandemic period compared to the pre-COVID-19 period.

These findings are reassuring in that they show that the onset of the COVID-19 pandemic does not appear to have resulted in a significant increase in delayed presentation or worse outcomes among boys with testicular torsion, at least among those patients who eventually make it to our doors. This suggests that personal concerns about the risks of COVID-19, or its impact on healthcare systems, do not appear to have impacted the willingness of patients and families to seek care for testicular torsion. One possible explanation may be related to the nature of this condition; the severity and acuity of symptoms associated with testicular torsion, including the incapacitating pain, associated nausea and vomiting, and visible swelling, make this condition difficult to ignore. Although adult hospitals in our city did see a dramatic drop in urgent presentations for stroke, heart attack and cancer during the COVID-19 crisis [11], parents may be more willing to risk exposure during the pandemic on behalf of their child than they might typically be willing to do for their own illness.

The loss of a testicle is perceived by substantial proportion of society as a significant impairment [12,13], and this may drive the tendency to present promptly in some patients and families. On the other hand, delayed presentation is a well-recognized phenomenon among testicular cancer patients, so clearly not all patients respond promptly to the mere recognition of an abnormality in the testis [13,14]. Efforts to determine the causes of delayed presentation in torsion have yielded mixed results and it is simply not clear why some patients delay and some do not

[15]. Although the embarrassment felt by some boys with this condition likely plays a role in not bringing the condition to anyone's attention, our data do not suggest that this phenomenon was more or less common during the COVID-19 crisis.

The apparent time difference between the median values for time to presentation and ischemic time might tempt us to speculate on possible explanations for why these times appear shorter during COVID-19; however, it should be recalled that although a difference of 3 h might be of clinical importance for an individual patient, these numbers represent median values and the analysis found that there was no statistically significant difference between the groups, rendering such speculation moot. The fact that the secondary outcome of orchiectomy was also not statistically different lends support to the premise that the times to presentation did not differ meaningfully, despite the apparent difference in median values.

Our finding that the number of torsion case per week increased during COVID-19 was surprising. One plausible explanation would be that, during COVID-19, a larger-than-normal proportion of regional torsion patients ended up in our facility, either because they were diverted or transferred from outside facilities due to reasons related to the pandemic, or because patients who normally might have gone to another facility in the area instead came directly to our facility for personal reasons. However, the fact that the proportion of patients transferred from an outside facility remained stable during both time periods means that the increase in the number of cases did not simply reflect higher rates of hospital-to-hospital transfer, and may have more complex underlying causes. Another possible explanation is that this was simply due to random chance, in which a cluster of torsion cases just happened to arrive during COVID-19 (although the difference was statistically significant).

These results of this study should be interpreted in light of its limitations. One limitation is that this is a convenience sample of those patients with torsion who presented to our facility. We are not able to analyze patients who presented elsewhere and were not referred to us, or who never presented to any medical facility. We sought to account for this possibility by looking at the number of torsion cases per week presenting to our facility during the study periods; our regional population during the study period was stable, and it would be reasonable to assume that the total incidence of torsion in the population served by our facility should also remain stable. If there were significant numbers of torsion patients simply staying home, then we might expect that the number of torsion cases presenting to our facility would decrease. However, we did not observe such a decrease; in fact, the number actually increased significantly. These findings are also specific to our region and may not be representative of, or generalizable to, other regions during the pandemic. For instance, hospital facilities in our region never became overwhelmed by COVID-19 patients and remained functioning throughout the first wave of the epidemic (although they were dramatically impacted and largely shut down to all non-urgent and non-COVID-19 care). A more severe local peak of

COVID-19 infection, one sufficiently intense to push local facilities past capacity (as was experienced in some other regions of this and other countries) might have had more significant and adverse impact on torsion outcomes.

## Conclusion

Time to presentation, ischemic times, and orchiectomy rates for testicular torsion at our center were not significantly different during the initial stage of the COVID-19 pandemic compared to the preceding 2 year period. The number of torsion cases per week presenting to our facility increased during the COVID-19 period, although the proportion of patients referred from other facilities remained unchanged.

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## Conflict of interest

None.

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