

Urethral Trauma Following Pelvic Fracture From Horseback Saddle Horn Injury Versus Other Mechanisms of Pelvic Trauma



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OBJECTIVE	To examine the rate of urethral trauma and pubic symphysis diastasis in saddle horn injury, which occurs when horseback riders are bucked into the air and land with their perineum striking the rigid saddle horn, compared to pelvic fracture from other mechanisms.
METHODS	A retrospective review was performed of male patients presenting to our level-1 trauma center with pelvic ring fractures between January 1, 2001 and December 30, 2016. Demographics, injury severity score, mechanism of injury (saddle horn vs other), pubic symphysis diastasis, and lower genitourinary (GU) injuries (bladder and urethra) were identified in the trauma registry. Chart review confirmed accuracy of lower GU trauma.
RESULTS	A total of 1195 males presented with pelvic ring fractures, average age 43 years (SD 19 years). Of these, 87 of 1195 (7%) presented with lower GU injuries. Saddle horn injuries had a higher rate of lower GU injuries, 12/60 (20%) versus 75 of 1135 (7%) [$P = .001$]. In those with lower GU injuries, 47 of 87 (54%) had urethral injury. The rate of urethral injury was significantly higher in the saddle horn cohort, 10 of 12 (83%) versus 37 of 75 (49%) [$P = .03$]. Furthermore, rate of pubic symphysis diastasis was higher amongst saddle horn injuries, 12 of 12 (100%) versus other mechanisms 39 of 75 (52%) [$P = .001$].
CONCLUSION	We found that urethral injury and pubic symphysis diastasis were higher in patients with saddle horn injury compared to other mechanisms of pelvic ring disruption. Clinicians should be aware of these associations when treating pelvic fracture following equestrian injuries. UROLOGY 124: 260–263, 2019. © 2018 Elsevier Inc.

The saddle horn was first introduced into the United States around 1800 via trade facilitated by the Santa Fe trail and was known as the Vaquero or Santa Fe saddle. This saddle design evolved into the California and Texas saddles, with variations based upon the topography of each area. The purpose of the saddle horn was to aid in the roping of calves and livestock. The saddle horn served as a fixed point to anchor the animal once it was successfully lassoed, a process called dallying. The saddle horn was originally constructed from wood, but in later versions metal was substituted to better withstand the forces of roping, saddle horns have persisted in many saddle designs in the United States, even those not

intended for ranch work, presumably due to considerations of style and an ode to tradition.

Saddle horn pelvic injury was first described by Mark Flynn in 1973,¹ occurring when an unfortunate horseback rider is bucked into the air and subsequently lands with their perineum striking the rigid saddle horn. The force generated by this impact is often sufficient to disrupt the cartilaginous pubic symphysis, allowing the pelvis to externally rotate leading to an “open-book” fracture.² This injury pattern has been shown to affect mostly males with some geographic variation.³ While urethral injuries are relatively infrequent, present in only 5%-10% of all pelvic fractures^{4,5} prior studies have demonstrated that urethral trauma is substantially more common following open-book pelvic injury.⁶ Urethral injury can lead to long lasting genitourinary (GU) morbidity.³

Prior studies have evaluated rates of sexual dysfunction resulting from such injuries,^{3,7,8} however, there is a paucity of contemporary literature evaluating rates of urethral injury in patients sustaining pelvic fractures secondary to horse riding injuries. The purpose of this study was to

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evaluate the rate of urethral trauma in patients after saddle horn related pelvic fracture, and to compare these patients to other patients with more conventional mechanisms of injury. We hypothesize that there is a higher rate of urethral trauma in saddle horn injury as compared to other pelvic fracture mechanisms.

MATERIALS AND METHODS

We conducted a retrospective review of all pelvic fracture records between January 2001 and December 2016 at the University of Utah Hospital (Salt Lake City, Utah), a level 1 trauma center that serves as a major regional referral hospital for the Western United States. Institutional Review Board approval was attained prior to commencement of this study. We limited our review to male patients greater than the age of 18 years old with documented pelvic ring fracture in our institutional trauma registry.

Using the trauma registry, we collected data on patient demographics (age, sex), injury severity score (ISS), mechanism of injury, presence of pubic symphysis diastasis, and the presence of a lower GU injury (bladder and urethra). The mechanism of injury was classified as either saddle horn (identified in electronic medical record as rodeo, animal, and equestrian) or other (motor vehicle accident, motorcycle accident, ATV injury, bicycle injury, crush injury, fall, and gunshot wound). Straddle injuries from nonequestrian sports were included in the other group. A chart review was then carried out on those patients with a documented lower GU injury to confirm mechanism of injury, distinguish urethral injury from bladder injury, and determine the presence of pelvic diastasis.

Our primary outcome measures were differences in rates of urethral injury and pubic symphysis diastasis following horseback injury compared to those occurring by other mechanisms. Statistical analysis of our primary outcome measures was conducted via *t* test for continuous and chi-square for categorical variables.

RESULTS

We identified 1195 males in our trauma registry that presented with pelvic ring fractures during a 15-year period (January 1, 2001 and December 30, 2016). Of these men, 60 of 1195 (5%) sustained pelvic fractures secondary to a saddle horn injury and 1135 of 1195 (95%) were due to other mechanisms of trauma (Table 1). The mean age of presenting individuals was 43 ± 19 years. There was no significant difference in age between the 2 groups of patients.

Out of the 1195 men, 87 of 1195 (7%) presented with confirmed lower GU injuries. There was a higher rate of lower GU injury in those individuals who fractured their pelvis due to saddle horn injury— 12 of 60 (20%) versus 75 of 1135 (7%) $P = .001$. Furthermore, saddle horn patients experienced urethral injury at a rate of 10 of 60 (17%) versus 37 of 1135 (3%) from the other mechanisms of injury ($P = .001$) (Table 1). The mean ISS at presentation, for all pelvic fracture patients, was 17 ± 12 . There was a significantly lower average ISS, in the saddle horn cohort (ISS 8 ± 16 versus 28 ± 13 , $P = .001$). Additionally, the rate of vascular injury was 0 of 12 (0%) in the saddle horn injury group versus 33 of 1135 3% in the other cohort.

In the 87 patients presenting with confirmed GU injury (Table 2), there was a higher rate of urethral disruption in the saddle horn injury group with 10 of 12 (83%) of the saddle horn group experienced urethral injury versus 37 of 75 (49%) of the nonsaddle horn cohort ($P = .03$). In addition, the rate of pubic symphysis diastasis was 12 of 12 (100%) among patients presenting with saddle horn injuries versus 39 of 75 52% in patients with other mechanisms of injury ($P = .001$). Pubic symphysis diastasis length was available for 60 of 87 (69%) of the lower GU injury cohort and this demonstrated no significant difference between mechanism groups (saddle horn 2.6 ± 1.3 cm versus other mechanism 2.8 ± 1.8 cm, $P = .252$).

COMMENTS

Our review of male patients presenting with confirmed pelvic fracture found that there was a higher rate of urethral injury and lower GU injury in patients presenting with pelvic fractures secondary to saddle horn injuries as opposed to other mechanisms of injury. Additional findings were a higher rate of symphysis diastasis and a lower ISS in patients with saddle horn related injury.

We found a total of 47 of 1195 (4%) urethral injuries overall, which is consistent with prior literature demonstrating a rate of 1.5%-10% occurring with all types of pelvic fractures.^{4,5} A total of 5% of the cohort was comprised of patients suffering from saddle horn injuries. This is in keeping with prior reviews of pelvic fractures related to horseback riding injuries.² As suspected, a much higher proportion of the saddle horn pelvic injury group demonstrated pelvic ring diastasis, urethral, and lower GU injuries. These findings are likely related to the higher rate of “open-book” pelvic fractures and direct perineal trauma

Table 1. Demographics and extent of injury

	Saddle Horn <i>n</i> = 60 (5%)		Other <i>n</i> = 1135 (95%)		<i>P</i> Value
	Avg/ <i>n</i>	%/SD	Avg/ <i>n</i>	%/SD	
Age	42	15	43	19	.599
Injury severity score	16	8	28	13	.002
Major vascular injury	0	0%	33	3%	.001
Any lower GU injury	12	20%	75	7%	.001
Urethral injury	10	17%	37	3%	.001

GU, genitourinary.

Comparison of saddle horn related lower genitourinary injuries versus other mechanisms of pelvic fracture.

Table 2. Urethral injury following pelvic trauma

	Saddle Horn Injury		Other Mechanism of Injury		P Value
	n = 12	%	n = 75	%	
Urethral injury*	10	83%	37	49%	.03
Major vascular injury*	0	0%	33	44%	.001
Injury severity score**	16 ± 8		28 ± 13		.002
Pubic symphysis diastasis	2.6 ± 1.3 cm		2.8 ± 1.8 cm		.252

Comparison of patients with confirmed urethral injury following pelvic fracture from either saddle horn or other mechanisms.

* Chi square

** t test

found in equestrian related injuries. Basta et al found that approximately 92% of urethral injuries following pelvic trauma are associated with pelvic symphysis diastasis or fractures of the inferomedial pubic ramus, with an approximately 10% increased risk of urethral injury with each millimeter increase in osseous separation.⁶ Additionally, pubic symphysis diastasis and displaced inferomedial pubic bone fractures were independent predictors of urethral injury in male patients with blunt trauma to the pelvis.

Authors have proposed that the length of pubic symphysis diastasis is proportional to the stretching of the membranous urethra, in turn causing partial or complete urethral distraction at the bulbomembranous junction.⁹ It would follow that pelvic diastasis would be larger in patients with saddle horn injuries as they had higher rates of urethral injury, however, in our study, while there was a higher rate of symphysis diastasis in the saddle horn group, we found no significant difference in average diastasis length between groups. This may be due to lack of sufficient power given the low number of saddle horn injuries and X-rays were not available in all patients to measure the degree of diastasis.

In this study, saddle horn injury patients were more likely to present with isolated pelvic trauma, which may explain the significantly lower ISS as compared to alternate mechanisms of injury. While classically pelvic ring fractures overall carry a high rate of general morbidity and mortality, Collinge et al also found that patients presenting with horseback riding related pelvic ring fractures had a lower ISS as compared to others. Further, while the blunt trauma of the saddle horn striking the perineum delivered a devastating blow to the anterior pelvis and local GU anatomy; these injuries were rarely associated with multisystem trauma.³

Although historically fatal, with mortality reaching 50%, pelvic fracture is presently viewed as a survivable injury with mortality ranging from 4%-15% depending on severity. Despite the considerable improvement in mortality outcomes, pelvic fracture is still associated with significant long-term morbidity in terms of chronic pain, as well as urinary tract and erectile dysfunction.^{2,3} It is therefore paramount that such injuries be identified and managed appropriately. Both the operative and medical management of urinary tract injury and sexual dysfunction following pelvic trauma are well-represented in the

literature.^{3,7,8} Due to the limitation of our retrospective review, the data were not available on the cohort and are therefore not included in this present study. Based on our findings, clinicians should suspect compromise of the GU system with equestrian sport related pelvic fracture that lead to rotational instability.^{3,6,10} In our review, every patient in the saddle horn injury cohort presented with some degree of pubic symphysis diastasis, likely increasing risks of urethral injury.

This study was limited by the inherent flaws of a retrospective review. It is difficult to determine an incidence for this form of injury in a national setting since Utah is positioned in an area where horses are used extensively for rodeo, recreation, and work. Due to our unique position as a major referral center in the Western United States, the 5% incidence of pelvic fracture secondary to horseback riding, likely represents an elevated incidence compared to elsewhere in the country. In addition, for the most part, injuries were directly related to the saddle horn in these patients, however, in some cases, patients may have been thrown or rolled on by the horse and the mechanism of the injury might not have been directly related to the saddle horn. The specifics of the mechanisms were not always exactly known by the victim or could not be extracted in chart review.

CONCLUSIONS

Saddle horn injury is an injury specific to horseback riding that often leads to open book pelvic fracture and GU trauma. We found that lower GU injury, urethral injury, and pubic symphysis diastasis rates were higher in patients with saddle horn injury compared to other mechanisms of pelvic ring disruption. Clinicians should be aware of these associations when treating pelvic fracture following horseback riding injuries. This is particularly pertinent to physicians practicing in the Western United States, where these types of horse related injuries are more prevalent.

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