
General surgeons' comfort and urologists' perceptions of bladder trauma management

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Introduction: Utilizing a physician-reported survey, we assessed general surgeons (GS) comfort level in the management of bladder trauma, from a GS and urologist's perspective.

Materials and methods: Online questionnaires were distributed electronically to physicians of the American College of Surgeons and American Urological Association. This survey queried demographic data, clinical factors that may influence urology consultations, and bladder injury scenarios of varying severities. Two questions were presented for each scenario, the first querying GS comfort level in bladder trauma management, the second assessing the likelihood of obtaining urology consultations in such scenarios. Responses were graded on a Likert scale.

Results: Overall, 108 (51%) GS and 104 (49%) urologists responded. When compared to managing

Grade I injuries, the comfort level of GS decreased as the severity of bladder trauma increased, while the likelihood of obtaining a urology consultation increased. While the perceived comfort of GS by urologists decreased from 84% to 5% for Grade I to Grade V injuries, GS reported a significantly higher comfort level (Grade I: 92%, $p = 0.09$; Grade V: 31%, $p < 0.001$). Majority of GS indicated that preoperative diagnosis on imaging (56%), intraoperative diagnosis (62%), and timing of patient presentation (76%), did not affect their decision to consult urology for assistance in bladder trauma ($p < 0.001$).

Conclusions: GS-reported comfort levels for bladder trauma management remains higher than urology-perceived comfort levels. Contrary to urologists' perception, most peri-injury factors did not affect GS decision to consult urology for bladder trauma. We hope this study can foster discussion and improve interdisciplinary collaboration in bladder trauma management.

Key Words: bladder, trauma, urology, general surgery, comfort

Introduction

In the United States, traumatic injuries account for 10% of all-cause mortality and incurs up to \$406 billion annually in healthcare expenditure and lost productivity.¹ Of these, genitourinary (GU) trauma comprises 10% of all traumatic injuries and is associated with significant patient morbidity and mortality. Bladder injuries constitute the third

most common urological injury in trauma patients, following kidney and urethral injuries.² A review of bladder trauma in the National Trauma Data Bank (NTDB) found that 76% occurred in males, 58% affected individuals younger than 40 years, and 83% were secondary to blunt trauma.^{3,4} Bladder injuries can be classified according to the American Association for the Surgery of Trauma (AAST) scale based on the severity and location of rupture.⁵ Traditionally, uncomplicated extraperitoneal bladder ruptures can be managed conservatively with urethral catheter drainage, while intraperitoneal injuries are treated with surgical repair.⁶⁻⁸

Bladder trauma is seldom an isolated injury and is often observed in the setting of polytrauma.⁹ Due to the close proximity of the bladder with the pelvis,

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over 80% of traumatic bladder injuries are associated with pelvic fractures, especially pubic rami fractures and pubic symphysis diastasis.¹⁰⁻¹² Urologists are commonly involved in the management of bladder injuries, however, it is not unusual for these injuries to be managed by general surgeons (GS) alone, particularly in acute traumatic settings. A recent review of a trauma registry out of Pietermaritzburg, South Africa, found that of 58 traumatic bladder injuries identified over 2 years, 53 (91%) cases were definitively managed by trauma surgeons alone. The remaining 5 (9%) cases required dedicated urological surgery assistance due to its complexity ranging from bladder neck avulsions to concurrent rectal/uterine injuries and concomitant injuries to the bladder trigone or ureteral orifices.¹³

Utilizing a physician-reported survey, we aim to describe the comfort level of GS in the management of bladder trauma a GS and urologist's perspective. We hypothesize that while GS comfort level may decrease with increasing bladder trauma complexity, there may still be discrepancies between the two specialties with regards to management of these injuries that may warrant continued interdisciplinary communication to improve coordinated care.

Materials and methods

Study design and questionnaire distribution

Institutional review board approval was obtained to perform a cross-sectional study assessing the perceptions of urologists and GS in the management of bladder trauma. A template questionnaire was developed in collaboration between the Departments of Urology and Surgery.

We contacted each chapter within the American College of Surgeons (ACS) for dissemination of our questionnaire to GS audience and the Society of Genitourinary Reconstructive Surgeons (GURS) and each section of the American Urological Association (AUA) for distribution of our survey among urologists. The surveys were reviewed and approved by select chapters of each society and distributed to their members as a single email with no follow up or reminder emails per organizational guidelines. The period for acceptance of survey responses was 1 month, from January to February 2021.

Study survey

The questionnaire is broadly divided into three main sections – demographic factors, bladder trauma clinical scenarios and other miscellaneous clinical factors that may influence urology involvement in

bladder trauma. A total of eight clinical scenarios with increasing severity of bladder injuries were presented. Two questions were presented for each scenario, the first querying the comfort level of GS in the management of bladder trauma, and the second assessing the likelihood of a urology consultation in such injuries. Urologists were surveyed on their comfort level of GS managing the presented scenario, and the likelihood of GS consulting urology for that specific type of bladder injury. Responses were rated on a Likert scale (1: least likely or least comfortable, 5: most likely or most comfortable). Lastly, non-demographic factors influencing the possibility of a urology consultation, e.g., time of patient presentation, intraoperative diagnosis of bladder injury or availability of preoperative imaging, were assessed. The survey took approximately 10 minutes to complete.

Statistical analysis

Demographic and survey responses were summarized with percentages and compared between the two specialties using Chi-squared test and Fisher's exact test where appropriate. The comfort level of GS and likelihood of urology consult for each bladder trauma scenario was analyzed using cumulative logistic regression models. The relationship between each bladder trauma injury and survey response was analyzed by fitting a multivariable proportional odds, adjacent-categories-ratio, or continuation-ratio model where appropriate. Backward stepwise variable selection for the multivariable model by elimination of the predictors with the greatest p value was performed.¹⁴ Similar multivariable analyses were performed to evaluate other relevant clinical factors that may affect the likelihood of urology consultations. Backward stepwise variable selection for the multivariable model by Akaike information criterion (AIC) was performed.¹⁵ All statistical analyses were performed using R statistical software version 4.1.1 (Vienna, Austria).

Results

There was a total of 212 physicians who responded to our survey – 108 (51%) GS and 104 (49%) urologists.

Demographic data

Table 1 highlights key demographic data. Most of our respondents were primarily from surgeons operating at Level I or II trauma centers (GS: 78% vs. urology: 77%, $p = 0.82$). The number of bladder trauma cases managed annually were similar between the two

TABLE 1. Demographic data

Survey questions	Variables	GS, n (%)	Urology, n (%)	p value
Number of years since completion of formal training	0-5 years	34 (31%)	56 (54%)	0.001
	6-20 years	40 (37%)	34 (33%)	
	21+ years	34 (31%)	14 (13%)	
Level of trauma center that you operate at	Level I	62 (57%)	58 (56%)	0.82
	Level II	25 (23%)	22 (21%)	
	Level III-V	21 (19%)	24 (23%)	
How many abdominal (GS) or genitourinary (Urology) trauma cases do you manage annually?	0-50 cases	60 (56%)	50 (48%)	0.55
	51-100 cases	23 (21%)	26 (25%)	
	100+ cases	25 (23%)	28 (27%)	
How many bladder trauma cases do you manage annually?	0-5 cases	82 (77%)	72 (69%)	0.49
	6-10 cases	15 (14%)	20 (19%)	
	11+ cases	10 (9%)	12 (12%)	
Underwent fellowship training (GS: trauma/ACS; Urology: trauma/reconstructive)	Yes	39 (36%)	40 (39%)	0.78
	No	69 (64%)	64 (61%)	
Sufficient and reliable urology support at your institution to help manage GU trauma	Yes	94 (90%)	93 (89%)	1.00
	No	10 (10%)	11 (11%)	
Presence of trauma/reconstructive urologist at your institution	Yes	19 (18%)	75 (72%)	< 0.001
	No	85 (82%)	29 (28%)	
Presence of GS residency program at your institution	Yes	73 (70%)	81 (78%)	0.27
	No	31 (30%)	23 (22%)	
Presence of Urology residency program at your institution	Yes	40 (39%)	74 (71%)	0.008
	No	64 (61%)	30 (29%)	
Presence of GS trauma/ACS fellowship program at your institution	Yes	37 (36%)	45 (43%)	0.32
	No	67 (64%)	59 (57%)	
Presence of Urology trauma/reconstructive fellowship program at your institution	Yes	4 (4%)	21 (20%)	< 0.001
	No	100 (96%)	83 (80%)	

GS = general surgery; ACS = acute care surgery; GU = genitourinary

cohorts ($p = 0.49$). While only 18% of GS have a trauma/reconstructive urologist in their institution, 90% of GS reported that they have sufficient and reliable urology support to help manage GU trauma. Both specialties had similar rates of GS residency ($p = 0.27$) and trauma/ACS fellowship ($p = 0.32$) programs at their institutions, but urology residency and trauma/reconstructive fellowship programs were far less common among the institutions in the GS cohort than that of the urology cohort (both $p < 0.01$).

Bladder trauma scenarios

Average Likert scores for GS comfort levels and likelihood of urology consultations as perceived by

both GS and urology are depicted in Table 2. Detailed survey responses for both specialties on each bladder trauma scenario is presented in Table 3. Table 4 demonstrates a multivariable analysis of the factors associated with GS comfort level and likelihood of GS obtaining urology consults when managing bladder trauma.

Comfort level of GS in the management of bladder trauma

The comfort levels of GS were significantly higher than that perceived by urologists in all scenarios ($p = 0.004$). While the perceived comfort of GS by urologists for the management of bladder trauma decreased from 84% to

TABLE 2. Average respondent survey scores on GS comfort level and likelihood of urology consultations during bladder trauma

Bladder trauma scenarios	Average comfort level in the management of bladder trauma			Average likelihood of urology consultations for bladder trauma		
	GS comfort, mean (SD)	Urology perception, mean (SD)	p value*	GS comfort, mean (SD)	Urology perception mean (SD)	p value*
AAST Grade I: Contusion/intramural hematoma or partial thickness laceration	4.52 (1.03)	4.32 (1.01)	0.004	2.52 (1.54)	3.03 (1.35)	0.049
AAST Grade II: Extraperitoneal bladder wall laceration < 2 cm	4.40 (1.03)	3.10 (1.35)		3.44 (1.55)	4.16 (1.26)	
AAST Grade III: Extraperitoneal (> 2 cm) or intraperitoneal (< 2 cm) bladder wall laceration	4.13 (1.12)	2.32 (1.29)		3.71 (1.52)	4.55 (1.00)	
AAST Grade IV: Intraperitoneal bladder wall laceration > 2 cm	3.92 (1.28)	2.09 (1.33)		3.88 (1.52)	4.76 (0.68)	
AAST Grade V: Intraperitoneal or extraperitoneal bladder wall laceration extending into the bladder neck or ureteral orifice (trigone)	2.64 (1.31)	1.23 (0.78)		4.70 (0.89)	4.91 (0.57)	
Pelvic fractures that result in exposed bone spicules in the bladder	2.81 (1.36)	1.54 (0.88)		4.36 (1.14)	4.83 (0.53)	
Bladder trauma injury with concurrent rectal or vaginal lacerations	3.24 (1.37)	1.51 (0.95)		4.30 (1.06)	4.80 (0.72)	
Bladder trauma injury in patients with pelvic fracture requiring open reduction internal fixation or external fixation	3.21 (1.40)	1.79 (1.02)		4.25 (1.14)	4.79 (0.52)	

GS = general surgery; AAST = The American Association for the Surgery of Trauma; *Independent student's t-test

5% for Grade I to Grade V injuries, GS reported a higher comfort level when faced with these injuries (Grade I: 92%, Grade V: 31%). GS comfort level was congruent with urologist's perception only for Grade I injuries (p = 0.09). GS reported a significantly higher comfort level than that perceived by urologists in Grade II-V and other complicated injuries (all p < 0.001). The comfort level of GS in managing bladder trauma decreased

significantly as the severity of bladder trauma increased. Factors affecting the comfort level of GS in bladder trauma management is highlighted in Table 4.

Likelihood of urology consultation in the event of bladder trauma

The rates at which GS would consult urologic surgery were significantly lower than that perceived

TABLE 3. Survey responses assessing the comfort level of GS and the likelihood of a urology consultation in the management of bladder trauma

Bladder trauma	Response	Perceptions of GS comfort level			Perceptions of urology consultation likelihood		
		GS, n (%)	Urology, n (%)	p value	GS, n (%)	Urology, n (%)	p value
AAST Grade I: Contusion/intramural hematoma or partial thickness laceration	EU	6 (6%)	1 (1%)	0.001	37 (39%)	17 (17%)	0.005
	SU	0 (0%)	9 (9%)		18 (19%)	25 (25%)	
	Neither	2 (2%)	7 (7%)		7 (7%)	13 (13%)	
	SC	18 (19%)	24 (24%)		17 (18%)	32 (31%)	
	EC	70 (73%)	61 (60%)		15 (16%)	15 (15%)	
AAST Grade II: Extraperitoneal bladder wall laceration < 2 cm	EU	4 (4%)	13 (13%)	< 0.001	18 (20%)	9 (9%)	0.013
	SU	2 (2%)	28 (28%)		11 (12%)	5 (5%)	
	Neither	7 (8%)	12 (12%)		5 (6%)	4 (4%)	
	SC	19 (21%)	28 (28%)		25 (28%)	27 (26%)	
	EC	59 (65%)	18 (18%)		31 (34%)	57 (56%)	
AAST Grade III: Extraperitoneal (> 2 cm) or intraperitoneal (< 2 cm) bladder wall laceration	EU	4 (4%)	32 (32%)	< 0.001	15 (17%)	4 (4%)	< 0.001
	SU	5 (5%)	36 (36%)		9 (10%)	4 (4%)	
	Neither	12 (13%)	8 (8%)		3 (3%)	2 (2%)	
	SC	24 (26%)	16 (16%)		23 (26%)	13 (13%)	
	EC	46 (51%)	8 (8%)		40 (44%)	78 (77%)	
AAST Grade IV: Intraperitoneal bladder wall laceration > 2 cm	EU	8 (9%)	48 (48%)	< 0.001	12 (13%)	1 (1%)	< 0.001
	SU	6 (7%)	23 (23%)		10 (11%)	1 (1%)	
	Neither	12 (13%)	8 (8%)		6 (7%)	5 (5%)	
	SC	24 (26%)	14 (14%)		10 (11%)	7 (7%)	
	EC	41 (45%)	7 (7%)		51 (57%)	86 (86%)	
AAST Grade V: Intraperitoneal or extraperitoneal bladder wall laceration extending into the bladder neck or ureteral orifice (trigone)	EU	25 (27%)	89 (89%)	< 0.001	4 (4%)	2 (2%)	0.020
	SU	18 (20%)	6 (6%)		0 (0%)	0 (0%)	
	Neither	20 (22%)	0 (0%)		2 (2%)	0 (0%)	
	SC	21 (23%)	3 (3%)		7 (8%)	1 (1%)	
	EC	7 (8%)	2 (2%)		77 (86%)	97 (97%)	
Pelvic fractures that result in exposed bone spicules in the bladder	EU	20 (22%)	63 (63%)	< 0.001	5 (6%)	1 (1%)	0.001
	SU	21 (24%)	27 (27%)		5 (6%)	0 (0%)	
	Neither	15 (17%)	5 (5%)		1 (1%)	1 (1%)	
	SC	22 (25%)	3 (3%)		19 (22%)	11 (11%)	
	EC	11 (12%)	2 (2%)		57 (66%)	87 (87%)	
Bladder trauma injury with concurrent rectal or vaginal lacerations	EU	15 (17%)	70 (70%)	< 0.001	3 (3%)	3 (3%)	< 0.001
	SU	13 (15%)	19 (19%)		6 (7%)	0 (0%)	
	Neither	14 (16%)	2 (2%)		4 (5%)	0 (0%)	
	SC	30 (34%)	8 (8%)		24 (27%)	8 (8%)	
	EC	17 (19%)	1 (1%)		51 (58%)	89 (89%)	
Bladder trauma injury in patients with pelvic fracture requiring open reduction internal fixation or external fixation	EU	14 (16%)	50 (50%)	< 0.001	5 (6%)	0 (0%)	< 0.001
	SU	17 (19%)	32 (32%)		4 (5%)	1 (1%)	
	Neither	14 (16%)	10 (10%)		6 (7%)	2 (2%)	
	SC	24 (27%)	5 (5%)		22 (25%)	14 (14%)	
	EC	20 (22%)	3 (3%)		51 (58%)	83 (83%)	

GS = general surgery; AAST = The American Association for the Surgery of Trauma

EU = extremely uncomfortable; SU = somewhat uncomfortable

SC = somewhat comfortable; EC = extremely comfortable

TABLE 4. Multivariate analyses of factors associated with general surgery comfort level and likelihood of obtaining urology consultation in the management of bladder trauma

Variables		GS comfort level OR (95% CI)	p value	Urology consultation likelihood OR (95% CI)	p value
Bladder trauma scenarios					
AAST Grade I		Referent		Referent	
AAST Grade II		0.45 (0.21-0.97)	0.04	8.99 (8.95-9.03)	< 0.01
AAST Grade III		0.17 (0.08-0.35)	< 0.01	19.09 (19.00-19.18)	< 0.01
AAST Grade IV		0.09 (0.04-0.19)	< 0.01	33.34 (33.19-33.50)	< 0.01
AAST Grade V		0.003 (0.001-0.008)	< 0.01	1194.89 (1189.22-1200.59)	< 0.01
Pelvic fracture with exposed bone spicules in bladder		0.005 (0.002-0.012)	< 0.01	157.06 (156.32-157.81)	< 0.01
Concurrent rectal or vaginal lacerations		0.013 (0.006-0.028)	< 0.01	99.38 (98.91-99.86)	< 0.01
Pelvic fracture requiring open reduction internal or external fixation		0.013 (0.006-0.029)	< 0.01	85.58 (85.17-85.98)	< 0.01
Years in practice	0-5	Referent		Referent	
	6-20	0.60 (0.20-1.77)	0.35	0.86 (0.85-0.86)	< 0.01
	21+	5.22 (1.67-16.35)	0.005	0.38 (0.10-1.44)	0.16
Level of trauma center	I	*	*	Referent	
	II	*	*	0.24 (0.07-0.88)	0.03
	III-V	*	*	0.39 (0.09-1.74)	0.22
Abdominal trauma cases managed annually	0-50	Referent		Referent	
	51-100	2.83 (0.83-9.64)	0.10	0.11 (0.03-0.53)	0.005
	101+	4.21 (0.92-19.17)	0.06	0.24 (0.03-1.74)	0.16
Bladder trauma cases managed annually	0-5	Referent		Referent	
	6-10	0.84 (0.23-3.11)	0.79	1.78 (0.31-10.31)	0.52
	11+	16.11 (1.98-131.38)	0.01	0.08 (0.006-0.98)	0.05
Fellowship training in trauma/ACS?	No	Referent		Referent	
	Yes	9.41 (2.86-30.90)	< 0.01	0.14 (0.04-0.56)	0.005
Sufficient and reliable urology support present?	No	Referent		Referent	
	Yes	36.61 (6.84-195.83)	< 0.01	0.18 (0.18-0.19)	< 0.01
Trauma/reconstructive urologist at your institution?	No	*	*	Referent	
	Yes	*	*	2.02 (2.01-2.03)	< 0.01
GS residency at your institution?	No	*	*	Referent	
	Yes	*	*	1.70 (1.69-1.71)	< 0.01
Urologic surgery residency at your institution?	No	Referent	*	*	*
	Yes	0.27 (0.10-0.79)	0.02	*	*
GS trauma/ACS fellowship at your institution?	No	Referent		Referent	
	Yes	0.39 (0.12-1.25)	0.11	1.28 (1.27-1.29)	< 0.01
Urologic trauma/reconstruction fellowship at your institution?	No	Referent		Referent	
	Yes	9.92 (0.73-134.93)	0.09	0.003 (0.00-0.06)	< 0.01

GS = general surgery; AAST = The American Association for the Surgery of Trauma; ACS = acute care surgery
 *Backward stepwise variable selection for the multivariable model by elimination of the predictors with the greatest p values were performed

by urologists in all scenarios ($p = 0.05$). While the perceived likelihood of GS obtaining urology consults increased from 46% to 98% for Grade I to Grade V injuries, GS reported a slightly lower consultation rate with these injuries (Grade I: 34%, Grade V: 94%). The likelihood of GS consulting urology was congruent with urologist's perception only for Grade I ($p = 0.11$) and Grade V injuries ($p = 0.15$). GS reported a significantly lower rate of consultations than that perceived by urologists in Grade II-IV and other complicated injuries (all $p < 0.01$). The likelihood of obtaining a urology consultation increased significantly with more complex injuries. Factors affecting the likelihood of obtaining urological consults during bladder trauma is highlighted in Table 4.

Other relevant clinical factors affecting likelihood of urology consultations

The majority of GS indicated that preoperative diagnosis on imaging studies (56%), intraoperative diagnosis (62%), and timing of patient presentation outside of normal working hours, including nights or weekend (76%), did not affect their decision-making process in consulting a urologist for assistance in bladder trauma. This is contrary to urologists' perception whereby urologists' thought that preoperative diagnosis on imaging, intraoperative diagnosis, and timing of patient presentation would make GS 78% more likely, 48% less likely, and 41% less likely to consult them for management of bladder trauma, respectively. Lastly, 82 (94%) GS and 92 (94%) urologists utilized a two-

TABLE 5. Multivariate analyses assessing other clinical factors that may affect the likelihood of urology consultations for bladder trauma

Variables	Preoperative diagnosis of bladder injury on imaging		Intraoperative diagnosis of bladder injury		Patient presentation outside normal working hours	
	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
Level of trauma center						
I	Referent		*	*	Referent	
II	0.31 (0.09-1.06)	0.06	*	*	0.25 (0.07-0.93)	0.04
III-V	1.26 (0.31-5.04)	0.75	*	*	0.60 (0.13-2.76)	0.51
Abdominal trauma cases managed annually						
0-50	*	*	Referent		Referent	
51-100	*	*	0.21 (0.06-0.70)	0.01	0.48 (0.12-1.87)	0.29
101+	*	*	0.33 (0.08-1.36)	0.12	0.22 (0.05-0.94)	0.04
Bladder trauma cases managed annually						
0-5	Referent		Referent		*	*
6-10	3.00 (0.83-10.86)	0.10	2.96 (0.83-10.58)	0.10	*	*
11+	0.29 (0.05-1.58)	0.15	0.70 (0.12-4.09)	0.69	*	*
Fellowship training in trauma/ACS?						
No	Referent		Referent		Referent	
Yes	0.20 (0.06-0.61)	0.005	0.23 (0.07-0.70)	0.01	0.35 (0.10-1.20)	0.10
Sufficient and reliable urology support present?						
No	*	*	Referent		*	*
Yes	*	*	0.14 (0.02-0.79)	0.03	*	*
GS trauma/ACS fellowship present?						
No	*	*	Referent		*	*
Yes	*	*	3.36 (1.23-9.16)	0.02	*	*
Urologic trauma/reconstruction fellowship present?						
No	Referent		Referent		*	*
Yes	0.09 (0.01-1.44)	0.09	0.18 (0.02-1.99)	0.16	*	*

GS = general surgery

ACS = acute care surgery

*Backward stepwise variable selection for the multivariable model by Akaike information criterion (AIC) was performed

layer bladder closure when repairing bladder injuries ($p = 1.0$), and 52% of GS who surgically managed a patient with bladder injury claimed that they would provide postoperative care for these patients, while the remaining 48% would defer post-operative management to urology. Table 5 demonstrates the multivariate analyses assessing demographic factors and other clinical factors that may affect the likelihood of urology consultations for bladder trauma.

Discussion

Although urologists commonly participate in the management and surgical repair of bladder injuries, it is not uncommon for GS to treat bladder injuries without urological involvement. The extent of collaboration between the two specialties may vary between type of institutions, complexity of bladder trauma, timing of patient presentation and institutional culture of urological involvement during trauma.^{16,17} The main goal of our study is to describe the GS comfort and the urologists' perception of bladder trauma management using a physician-reported survey. Intuitively, we found that the comfort level of GS in managing complicated bladder trauma without urology involvement decreased as injury severity increased. This is due to the increasing complexity requiring more specialized evaluation and treatment planning with increasing AAST grade. Additionally, in more severe cases of bladder injuries, there is also a higher risk for sustaining injuries to surrounding structures, including the rectum and vagina, or other urologic organs, with the most common being the urethra in 6% of patients, in which implications for more specialized reconstruction may be necessary to prevent long-term complications, such as urinary incontinence or stricture formation.^{18,19} Patients sustaining concomitant pelvic fractures, which is associated with higher injury severity score (ISS), are also more likely to have urological surgery involvement for associated bladder trauma due to the increased likelihood of polytrauma requiring multiple expertise consults to manage each individual injury.²⁰⁻²² As such, with specific specialty training, it is more likely that GS involve their urology colleagues for surgical repair of more complicated injuries.

Interestingly, survey responses found that urology perceptions were not consistently congruent with GS responses. The general trend is that GS were more comfortable managing bladder injuries and less likely to consult urologists than perceived by their urology colleagues in all the clinical scenarios presented in the survey. This finding is less pronounced in Grade I and

Grade V injuries as the clinical presentation for these patients may be more obvious on whether urologists need to be involved. It is important to note that our questionnaire only assessed for GS comfort level in managing bladder injuries, which does not directly imply whether GS would repair the injury. In these situations, GS may elect against fixing these injuries and defer to a urological colleague due to various reasons including standard of care, litigation risk, time management from an already heavy case load, institutional regulations and not wanting to overstep their urological colleagues, especially in the academic setting where urologic trainees and attendings are readily available for assistance and consultation. As such, this may explain the discrepancies in perceived comfort level and consultation rates from a urologists' perspective who is acting as the consulting team in the event of a bladder trauma in the real-world setting.

We found that timing of patient presentation made no difference on whether urologists were consulted for bladder trauma management. Based on survey responses in the clinical scenarios, urology consultations seemed to be appropriately obtained, with increasing likelihood of consultations occurring with increasing complexity of injuries. The 16% of respondents who were less likely to call urology consults during non-working hours were likely based in smaller-scaled community hospitals where specialist availability may be scarce (OR 0.60, 95% CI 0.13-2.76, $p = 0.51$). We also found that preoperative imaging may play a role in obtaining urology consults with 40% of GS indicating that they were more likely to consult urology if a preoperative CT scan demonstrated evidence of bladder injuries. Conversely, 62% GS indicated that intraoperative diagnosis of bladder injuries did not influence their decision to consult their urology colleagues. A study by Hsieh et al reported an average time of 2.4 hours to diagnosis of bladder injuries in patients who underwent an exploratory laparotomy without imaging studies. This is compared to an average of 3.5 hours in patients who were diagnosed on imaging.²³ This may suggest that patients who did not have time to undergo preoperative imaging were more hemodynamically unstable at presentation, requiring more urgent surgical intervention with less opportunities to consult specialty teams and vice versa. In these cases, injuries identified incidentally during emergent exploratory laparotomy may be repaired intraoperatively by GS if deemed simple and straightforward, thus avoiding a urological consult altogether.

GS who are trauma/ACS fellowship trained, those who manage a higher volume of abdominal trauma,

and those with sufficient and reliable urology support were less likely to consult urology despite preoperative evidence of bladder injuries on imaging, intraoperative diagnosis of bladder rupture or patient presentation outside normal working hours. In Level II trauma centers, we found that GS tends to consult urology less during bladder injuries, especially outside of normal working hours (OR 0.25, 95% CI 0.07-0.93, $p = 0.04$), likely due to the decreased availability of a surgical subspecialty in a smaller, community setting. This circumstance is more pronounced at midnight or over the weekend where urology coverage may be even more limited. Also, we found that 52% of GS who surgically managed a patient's bladder injury intraoperatively would provide postoperative care and determine the timing of performing a cystogram or urethral catheter removal without urology involvement. We found that physicians with longer years in practice (OR 4.67, 95% CI 1.20-18.20, $p = 0.03$) and those who manage a higher volume of abdominal trauma annually (OR 4.66, 95% CI 1.34-16.19, $p = 0.02$) were more likely to do so. These findings suggests that, even in certain extenuating circumstances, some experienced GS may feel comfortable managing certain degrees of bladder trauma and improved interdisciplinary communication between specialties can expedite patient care when a urology consult is called.

On multivariable analyses, we found that GS with more years in practice, those who manage a higher volume of abdominal or bladder trauma cases annually and those who have previously undergone trauma/ACS fellowship training have an overall higher comfort level for managing bladder trauma and higher threshold for consulting urology for co-management. Previous studies have demonstrated that GS are able to manage traumatic bladder injuries without compromising patient outcomes in the absence of urologists in select cases.²⁰ In this instance, through rigorous residency and fellowship training as well as years of practice in the clinical setting, the more experienced surgeon understands their limitations, can identify the appropriate case that can be safely managed conservatively, and recognize the optimum timing for when to consult their urological colleagues for the best patient outcome.

We also found that there is decrease in urology consultation rates in Level II trauma centers as compared to Level I centers, but an increase in urology consultation rates in institutions where a fellowship-trained trauma/reconstructive urology attending is available. In smaller-scaled hospitals, GS are likely to be the forefront of management when a trauma

patient presents. There is also less specialist support available in these situations which may explain this finding. Conversely, we find that in institutions where a fellowship-trained trauma/reconstructive urologic surgeon is available, GS are two times more likely to consult urology for bladder trauma. In the presence of academic residency programs, this may also enrich the educational experience and allow for the continuous exposure to a variety of GU pathologies and clinical presentations to residents prior to assuming full responsibility during independent practice.

Interestingly, we found that the comfort level was higher, and the consultation rates were lower in GS who indicated that they have reliable and adequate urological support at their institution. We postulate that in these situations, GS may feel more comfortable approaching and managing bladder trauma knowing that they can always consult their urological colleague should complications arise throughout the patient's hospital stay. As such, they may take on the initial responsibility and initiative to manage these patients until further specialist input is deemed necessary.

Our study is not without limitations. First, the use of our non-validated survey was limited to those with email access and those who were members of the societal organization. As not all regions and chapters allowed us to distribute our survey, we were limited by sample size and there was also a limited geographical distribution, which may potentially result in selection bias. Survey data is also subject to respondent recall bias. Next, while the questionnaire assessed a respondent's comfort level with each injury, this does not indicate whether they would repair the injury. While some surgeons may feel comfortable with managing bladder injuries, they may elect against treating it due to logistical or institutional regulations. There were also other clinical characteristics and pertinent surgical history regarding the trauma that were not queried, e.g., size of bladder injury or presence of any other concomitant urologic injuries that may significantly affect the split decision-making process in the trauma bay or operating room.

Conclusions

While GS are more likely to involve urologists in the management of bladder trauma as the complexity of bladder injuries increase, we found that the comfort level of bladder trauma management by GS was perceived to be much lower from a urologist's perspective. Contrary to urologists' perceptions, majority GS indicated that most peri-injury factors did not affect their decision to consult urology for

assistance and even in extenuating circumstances, certain severities of bladder trauma may be comfortably managed in the experienced GS hands. Although we only had a small representation of the GS and urology workforce responding to the survey, our hope is that this information can provide a framework to foster discussion and improve interdisciplinary collaboration between GS and urology for the management of bladder trauma. With improved multidisciplinary communication and a better understanding of respective specialty guidelines, prompt and high-quality surgical care can be provided to all trauma patients in the future. □

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