



# Epidemiology of Traumatic Adrenal Injuries Requiring Surgery

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<b>OBJECTIVE</b>	To analyze adrenal injuries using the National Trauma Data Bank. Adrenal trauma is rare and current literature is lacking in data from large case series.
<b>METHODS</b>	A retrospective analysis of the National Trauma Data Bank from the years 2007-2011 was performed. Patient demographics, Injury Severity Score (ISS), mechanism of injury, type of trauma, associated injuries, and development of shock were assessed. Multivariable models were used to determine association with outcomes, such as characterization of injury, need for adrenalectomy, intensive care unit admission, and death.
<b>RESULTS</b>	Of the 1,766,606 trauma cases recorded, 7791 involved 1 or both adrenal glands (0.44%). Common associated injuries were to the ribs (50.9%), thorax (50.0%), and liver (41.6%). Eighty adrenal injuries required surgery (80/7791, 1.0%), none of which were isolated adrenal injuries (0/120, $P = .63$ ). Higher ISS ( $P = .009$ ), Black race ( $P = .031$ ), penetrating injury ( $P < .001$ ), and splenic ( $P < .001$ ) and intestinal injuries ( $P = .018$ ) were associated with need for adrenalectomy. No isolated adrenal injuries were associated with death (12% vs 0%, $P < .0001$ ). Older age ( $P < .001$ ), higher ISS ( $P < .001$ ), chronic kidney disease ( $P = .009$ ), penetrating injuries ( $P < .001$ ), and injuries to the aorta/vena cava ( $P = .008$ ), peripheral vasculature ( $P < .0001$ ), thorax ( $P = .029$ ), brain/spinal cord ( $P < .001$ ), and abdominal polytrauma ( $P = .005$ ) were associated with mortality.
<b>CONCLUSIONS</b>	Adrenal injuries are rare, comprising 0.44% of recorded traumatic injuries. Isolated adrenal injuries were not fatal and did not require surgery, and thus should be managed conservatively. Detection of adrenal injury in polytrauma patients is key, particularly penetrating trauma and concurrent splenic and/or intestinal injuries, as these patients are more likely to require adrenalectomy. UROLOGY 94: 227–231, 2016. © 2016 Elsevier Inc.

Adrenal trauma is rare due to its location in the retroperitoneum and the adjoining soft tissues, with rates from 0.15% to 0.22% previously reported in the literature.<sup>1,2</sup> Injuries to the adrenal gland are attributable to both blunt and penetrating trauma, and this is usually in conjunction with injuries to adjacent organs.<sup>3,4</sup> Although uncommon, adrenal injuries may be associated with significant morbidity often secondary to hemorrhage, and surgery may be required.<sup>5</sup>

Given the infrequency of traumatic adrenal injury, little is known about the characterization, requirement for adrenalectomy, intensive care unit (ICU) requirement, and mortality of these traumas, and large institutional series are lacking. Herein, we report an analysis of adrenal injuries using the large-scale National Trauma Data Bank (NTDB).

## METHODS

We performed a retrospective analysis of the NTDB from 2007 to 2011. The following International Classification of Diseases-9 diagnosis codes were used to identify adrenal injury: 868.01, 868.11, 868.09, and 868.19. The dataset was limited to patients  $\geq 16$  years of age. The following codes were used to determine if the patient received an adrenal procedure: 7.22, 7.29, 7.3, 7.43, 7.44, and 7.49. The algorithm used to select patients can be seen in Figure 1. Patient demographics, Injury Severity Score (ISS), mechanism of injury, blunt vs penetrating trauma, associated injuries, and hypovolemic shock were assessed.

Multivariable logistic regression models were used to determine associations with outcomes such as length of stay greater than 10 days, need for ICU, need for adrenal procedure, isolated adrenal injury, and death. Wilcoxon rank-sum test were used to compare continuous normally and nonnormally distributed variables, respectively. All statistical analyses calculated were 2-sided with significance of 0.05. SAS version 9.3 was used for all calculations.

## RESULTS

Of the 1,766,606 trauma cases in the dataset, 7791 were identified involving 1 or both adrenal glands (0.44%). There

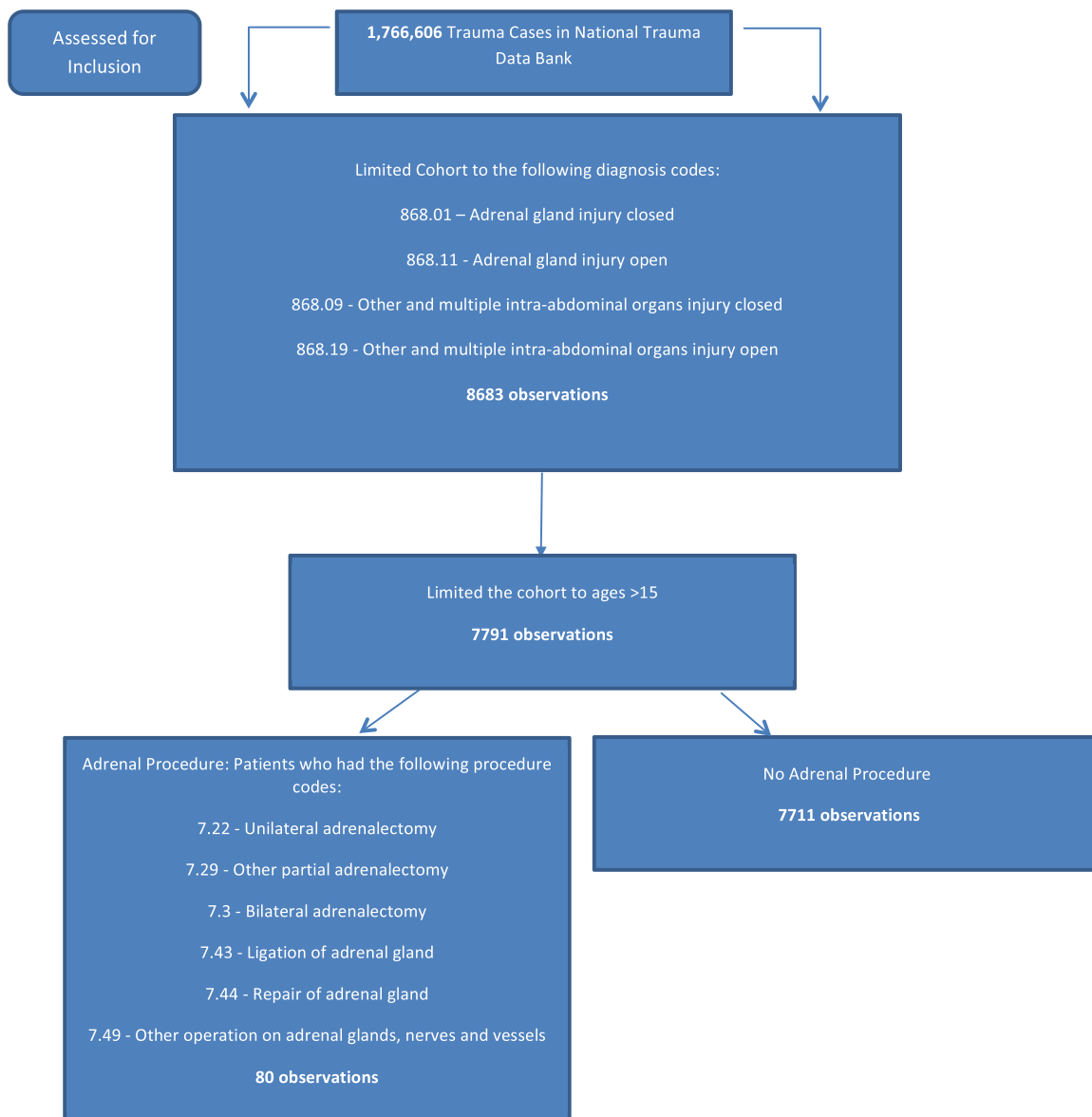
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**Figure 1.** Patient selection algorithm. (Color version available online.)

were 7026 blunt, 646 penetrating, and 119 unclassified injuries. The most common associated organ injuries were to the ribs (50.9%), thorax (50.0%), liver (41.6%), vertebrae (30.9%), kidney (27.8%), and spleen (22.0%). Of the adrenal injuries, 120 were isolated to the adrenal glands (120/7791, 1.5%). Factors associated with isolated adrenal injury include lower ISS ( $P < .001$ ), female gender (0.022), younger age ( $P = .009$ ), Caucasian race ( $P = .031$ ), and penetrating injury ( $P < .001$ ). Details regarding isolated adrenal injuries can be found in [Table 1](#).

Eighty adrenal injuries required surgery (80/7791, 1.0%). Logistic regression showed that higher ISS ( $P = .009$ ), race (Black) ( $P = .031$ ), penetrating injury ( $P < .001$ ), and concurrent injuries to the spleen ( $P < .001$ ) and intestines ( $P = .018$ ) were associated with a higher likelihood of requiring adrenal surgery. Injuries to the peripheral

**Table 1.** Multivariate analysis of isolated adrenal injuries

	OR	95% Confidence Interval		P Value
ISS	0.69	0.651	0.727	<.0001
Age	0.98	0.97	0.996	.009
Sex (F)	1.72	1.08	2.74	.022
Hypotension	0.76	0.239	2.433	.647
Race				
Caucasian	0.48	0.25	0.94	.031
Asian	0.29	0.035	2.361	.245
Black	0.46	0.217	0.956	.037
Other	0.40	0.191	0.855	.017
Unknown	1.00	0.452	2.23	.991
Injury type				
Unspecified	1.69	0.348	8.239	.514
Penetrating	3.84	2.238	6.599	<.0001

F, female; ISS, Injury Severity Score; OR, odds ratio.

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