☐ A NOMOGRAM PREDICTING THE NEED FOR BLEEDING INTERVENTIONS AFTER HIGH-GRADE RENAL TRAUMA: RESULTS FROM THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA (AAST) GENITOURINARY TRAUMA STUDY.

Keihani S, Rogers DM, Putbrese BE, et al. *J Trauma Acute Care Surg*. 2019 Feb 7. doi: 10.1097/TA.0000000000002222

The American Association for the Surgery of Trauma (AAST) has assigned a grading scale for renal injury in trauma that assigns high-grade renal trauma (HGRT) as levels III-V. Some patients with HGRT require surgical management including nephrectomy but many other patients have good outcomes with non-operative management. Currently no guidelines exist to inform management of renal injury based on clinical and radiologic data.

The objective of this study was to create a nomogram to describe likelihood of surgical intervention for bleeding in HGRT. This study collected data on clinical and radiologic factors present in patients with HGRT and whether or not they had a bleeding intervention. These data were collected between 2014-2017 from 14 Level 1 Trauma centers as part of the Genito-Urinary Trauma Study, which was a prospective multi-institutional collaborative effort between AAST and the Trauma and Urologic Reconstruction Network of Surgeons (TURNS). Clinical variables collected for analysis were age, sex, trauma mechanism (blunt vs penetrating), side of renal injury (right, left, bilateral), injury severity score (ISS), hypotension/shock (defined as systolic blood pressure <90 mmHg at any time during the first 4 hours from admission), glascow coma scale (GCS), blood products needed in the first 24 hours, admission lab values, and presence of any concomitant injury (solid organ, gastrointestinal, spinal cord, major vascular, pelvic fracture). Radiologic variables included assessed presence of active bleeding, size and extension of hematoma and laceration location (lateral, medial, complex). Definition of interventions included nephrectomy, partial nephrectomy, renorrhaphy, renal packing and renal angioembolization. For this study, 2 radiologists who were blinded to patient outcomes, intervention and clinical factors assessed the CT scans for radiologic findings. Comparisons were made between the patients who underwent intervention and those who did not. Stepwise regression was performed to discover which variables affected the likelihood of intervention.

326 patients met the clinical and imaging inclusion criteria. Of the included patients, 81% of trauma was blunt and 47 patients (14%) underwent bleeding intervention, including 19 renal angioembolizations and 16 nephrectomies. In the bleeding intervention group there were higher incidences of penetrating injury, higher-grade renal injury, vascular contrast extravasation (VCE) and larger hematomas. In regression, the factors most predictive of bleeding intervention were penetrating mechanism of injury, presence of VCE and increasing hematoma rim distance (HRD). Point values were assigned to the nomogram based on predictive strength of each variable. The sum total of these points ranges from 0 to 180, and this total score corresponds to a likelihood of bleeding intervention (0-100%). The calculated AUC was 0.83 (95% CI: 0.81-0.85), which indicated the nomogram performed better as a predictor for intervention than simply using the AAST grading system alone (AUC 0.69; 95% CI: 0.61–0.77). The nomogram is currently undergoing external validation.

The authors conclude that this nomogram is a novel tool that, compared with the AAST grading system alone, can more accurately predict which patients with HGRT may need a bleeding intervention or who could be managed conservatively. This may be an effective starting point for the standardization of management of HGRT.

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Commentary: Surgical versus conservative management in HGRT has historically been mostly a judgement call. This is the first attempt to assist clinicians in predicting who needs a bleeding intervention in patients who were stable enough to obtain imaging (of note, those who required immediate operative intervention were excluded). If externally validated, this nomogram may be especially helpful for more remote or rural facilities without direct access to Trauma Surgery or Interventional Radiology as it will help inform the decision to transfer for surgical care. Inter-facility transfer carries its own risks and expenses. Both the patient and the healthcare system will benefit from more accurate assessment of which patients need operative versus non-operative management of HGRT.

☐ CLEARING THE CERVICAL SPINE IN PATIENTS WITH DISTRACTING INJURIES: AN AAST MULTI-INSTITUTIONAL TRIAL.

Khan AD, Liebscher SC, Reiser HC, et al. *J Trauma Acute Care Surg*. 2019; 86(1): 28-35

This trial aimed to demonstrate that the cervical spine can be cleared using only the physical examination in the setting of blunt trauma despite the presence of distracting injuries. Single center trials have suggested that clinical examination of the cervical spine in blunt trauma patients with a distracting injury (DI) is a sensitive measure to exclude cervical spine injury, and this study attempted to further validate this conclusion using a multicenter assessment of the sensitivity of clinical examination.

This prospective 42 month study evaluated adult blunt trauma patients at eight level 1 trauma centers using a standardized cervical spine examination. All patients that suffered a blunt mechanism of trauma, were age 18 years or older, and had a glasgow coma scale (GCS) score of 14-15 were enrolled. There were no further exclusion criteria. All patients were questioned and examined, and if no neurological deficits were present, their cervical spine was held in manual stabilization while the standardized physical exam was performed to determine the presence of any pain. The physical examination was performed by either the attending trauma surgeon, the trauma surgery resident, or the trauma surgery APRN. Whether or not the patient had pain, they were potentially placed back into their collar depending on institution protocol, and all patients received computed tomography (CT) imaging of their cervical spine. Only CT scan results interpreted by radiology attendings were used for data collection. Distracting injuries in the study included long bone fractures, skull fractures, facial fractures,

and intracranial bleeds, among others. The primary outcome was a missed clinical injury, defined as an injury missed by clinical exam but identified on imaging.

During this study, 2,929 patients were enrolled. 2,058 patients were identified as having at least one DI. Of the 2,929 patients enrolled, cervical spine injuries were found on CT in 222 patients (7.6%). Of the entire study population, clinically-missed cervical spine injuries occurred in 25 patients (0.8%), and the study found no significant difference in the rate of clinically missed cervical spine injuries between those with and without a DI. Study patients with a DI were significantly less likely to have a cervical spine injury than patients without a distracting injury (6.6% vs. 10.0%, p= 0.0016). In regards to detecting cervical spine injury, physical exam was 89.6% and 87.4% sensitive in those with and without a DI, respectively. Physical exam was 88.7% and 78.0% specific in those with and without DI, respectively. The negative predictive value of a negative physical examination was 99.2% and 98.2% in patients with and without a DI, respectively. The positive predictive value of a positive cervical spine examination was 35.8% and 30.8% in patients with and without a DI, respectively.

The authors of this study concluded that a distracting injury in an awake and alert patient with a GCS of at least 14 should not exclude them from having cervical spine clearance based on a negative physical exam in the setting of blunt trauma. The authors state there is no evidence to support the use of radiographic imaging of the cervical spine in all patients with a distracting injury, and that the adoption of more evidence-based practice could help curb resource over-utilization and costs.

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Comment: This is the first multi-center prospective study attempting to debunk the theory that a distracting injury makes our clinical exam for cervical spine injury less reliable in blunt trauma. These data add to the growing body of evidence that distracting injury may not be truly distracting, and that possibly those with distracting injury actually have a lower prevalence of cervical spine injuries overall. The overall number of missed injuries is concerning, however, as it is higher than expected and threatens the generalizability of this study to other sites.

☐ EFFECT OF INTRANASAL KETAMINE VS FENTANYL ON PAIN REDUCTION FOR EXTREMITY INJURIES IN CHILDREN: THE PRIME RANDOMIZED CLINICAL TRIAL.

Frey TM, Florin TA, Caruso M, et al. *JAMA Pediatrics*. 2019;173(2):140-146

Extremity injuries in children are a common presenting complaint in the Emergency Department. Inadequate pain control in children is a continued problem, in part due to increased time to obtain intravascular access compared to adult patients. The intranasal route is a rapid-acting alternative route for pain control. Ketamine is a promising alternative to opioids in situations in which opioids are contraindicated or confer increased risk, such as prior to procedural sedation. Current studies comparing intranasal ketamine to fentanyl are limited by conservative dosing and coadministration of other forms of pain control.

The objective of this prospective double-blinded randomized clinical trial was to demonstrate that intranasal ketamine is not inferior to intranasal fentanyl for pain control in extremity injuries in children. Children 8-17 with an acute extremity injury and a visual analogue scale (VAS) scores greater than 35mm (moderate to severe pain) who had not received opioids prior to arrival were selected. Exclusion criteria included inability to obtain a VAS score, Glasgow coma scale (GCS) less than 15, significant injury to the head or trunk, abnormal nasal anatomy or nasal trauma, epistaxis, allergy to one of the study agents, in police custody, and postmenarchal girls who did not have a documented negative pregnancy test. Subjects were randomized to receive either 1.5 mg/kg of intranasal ketamine or 1.5 mg/kg of intranasal fentanyl. All ED and study staff involved were blinded as well as patients and their families. Medications were delivered in de-identified syringes containing premixed weight-based doses rounded to the nearest 0.1 mL. Baseline VAS scores were recorded and scores were monitored at 15, 30, and 60 minutes post-administration. Video monitoring provided continuous vitals for the first 15 minutes post-intervention. Patients were monitored for 120 minutes total for adverse events and abnormal vital signs. A non-inferiority margin of 10mm was chosen for statistical analysis of the primary outcome of reduction of VAS 30 minutes after medication administration. Secondary outcomes included adverse events experienced, change in vital signs, level of sedation achieved, and rescue analgesia requirements.

Ninety patients were randomized. Five participants dropped out of the study, leaving 43 patients randomized to the ketamine group and 42 randomized to the fentanyl group. At 15, 30, and 60 minutes, both groups experienced significant pain reduction at each time interval with similar reduction in pain in both groups and with no difference in the use of additional rescue analgesics. For the primary outcome, intranasal ketamine was noninferior to intranasal fentanyl for pain control at 30 minutes post-treatment. The ketamine VAS difference was −30.6mm (95% CI −35.8 to −25.4), compared to the Fentanyl VAS difference of −31.9mm (95% CI of −37.2 to −26.6). The ketamine group did experience more adverse events with 77% of patients experiencing at least one compared to 31% in the Fentanyl group, but these events were considered minor and self-limited. There was no significant difference in vital sign changes between the two groups and no vital sign changes that required intervention. Highest achieved sedation scores were also not significantly different between groups, with no scores above a two on the Michigan Sedation Scale score.

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The authors suggest that ketamine is noninferior to opioids for analgesia and although ketamine may cause more side effects, these were considered transient and minor. They conclude that ketamine would be a good alternative to opiates in the setting of acute fractures in pediatric patients.