DPM NEWS

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Case Study

A case study of a female patient experiencing abdominal pain. Do you know what should be at the top of your differential? Dr. Cushman breaks it down on *page 3*.

Tired?

Do you work Monday through Friday, 9-5? If so, you probably don't work in EMS. Can anything be done to mitigate the chronic exhaustion of EMS shift work? See *page 5*.

Special K

How are we doing with administering Ketamine? Take a look on *page 8*.

It might just be me but throughout this year I have felt like the rate of change for our constantly evolving world of EMS in this region, and statewide, has accelerated. The derivative of the change function has picked up. Locally, agencies have merged, stopped operating, and transferred certificates of need. The MCC paramedic program underwent a major structural overhaul. Statewide, new policies restructured how EMS instructors obtain recertification, the CME recertification process for providers was stretched to four years from three with changes to the education standards, and the traditional single-day testing model for certification exams was replaced. All this as you try to keep up with the progression of evidenced-based medicine as it changes (hopefully, improves) your care and upends some of your long held ideas about best practices for certain conditions.

Trying to digest all of this change while maintaining your certifications, doing your protocol updates, typing charts, taking state-mandated sexual harassment training, trying to get lunch, and maintaining a stable family life is difficult. When you're overwhelmed, just remember to do the right thing for your patient. That's the most important thing at any given moment, really the only thing, and you can work out the rest later. I hope you enjoy the articles and find the content useful in this first edition of DPM News for 2020.

Eric Rathfelder
Editor-In-Chief

EMS Education in Revision: The Ongoing National EMS Education Standards Update

by Albert Shih, MD

In 1996, the National Highway Traffic Safety Administration (NHTSA) published The EMS Education Agenda for the Future, a vision document that outlined the future of EMS education. This consensus document, which was co-developed by many stakeholders, defined the components of the EMS educational system including the National EMS Core Content, National EMS Scope of Practice Model,

Upcoming Events

Melinda Johnston

For more information about any event listed below, please visit the training calendar at MLREMS.org

January

27 - MLREMS Council

February

17- REMAC

March

16 - MLREMS Council

27 - 31 DPM Cadaver Lab (registration required)

National EMS Education standards, National EMS Education Program Accreditation, and National EMS Certification.

The first iteration of the National EMS education standards was published in 2009. These standards replaced the old NHTSA curriculum and defined the competencies, knowledge base, clinical judgements, and educational infrastructure required by providers at all levels of training to meet the national EMS Scope of Practice. Since then, this document has provided the starting point for EMS Education across the country. Indeed, paramedic program accreditation requires that the Education Standards form the basis of the curriculum.

As the practice of EMS medicine has grown and changed, so has the need to update the EMS scope of practice and Education standards. The revised National EMS scope of practice model, which defines the *recommended* minimum knowledge and skills at each level of practice (not necessarily followed by every state), was released in 2019 (https://www.ems.gov/pdf/National_EMS_Scope_of_Practice_Model_2019.pdf). A number of updates were made based on research which demonstrated improvement in patient outcomes. These included the use of opioid antagonists (by all-level providers), targeted temperature management (post ROSC), pain management in acute trauma, hemorrhage control, and CPAP/BiPAP at EMT level. As such, the educational standards are in need of update to reflect current EMS practice and incorporate the most up-to-date evidence.

The current revision process is being lead by the National Association of EMS Educators (NAEMSE). An initial draft was released this past summer and has since completed its first open public comment period. A second draft and public comment period will follow in 2020. Below are some of the highlights of proposed changes to the current educational standards:

All Levels:

- Communication and Crew resource management
- Mental health and wellness
- Verbal de-escalation strategies/difficult patient encounters
- Understanding of opioid toxicity at all levels

EMR:

- Basic understanding of medication safety and medications used in emergencies
- Use of an epinephrine autoinjector and delivery of premeasured intranasal medication (i.e. Narcan).

EMT:

- Transmission of clinical data/telemetry
- Involuntary consent
- Basic pharmacology, medication interactions, and toxicology

- Knowledge base to include understanding the name and use of chronic/maintenance medications typically used by patients
- Understanding of the quality of breath sounds
- 12-lead ECG (obtain/transmission) and obtaining a blood glucose level
- Recognize high pressure/injection injury
- Recognize BRUE (brief resolved unexplained event), previously known as ALTE

AEMT:

- Techniques of physical examination for other major body organ systems
- Blood collection

Paramedic:

- Knowledge of infections diseases such as: Tuberculosis, meningitis, and emerging infectious diseases
- Recognize Malignant Hyperthermia, serotonin syndrome, adverse reactions from non-FDA approved medications

Looking through many of the changes, a majority of them are an expansion on previously expected knowledge bases. Some examples include changes in terminology (ALTE to BRUE) and an increased emphasis on being able to identify additional toxidromes.

As far as diagnostics and procedures, there is also a push for EMTs to be able to perform glucose checks, 12-lead ECG at the national level (many protocols across the US already allow this) and expanding the ability for EMR to perform additional medication administrations such as epinephrine autoinjectors and Narcan.

There is also an emphasis on topics of provider mental health, wellness, and resilience and discussions on how to handle difficult patients with verbal de-escalation strategies.

Keep in mind that many of these proposed changes are still in the editing phase and may change. If you are interested in contributing to the latest national EMS educational standards, you can visit the project page at https://www.ems.gov/projects/ems-education-standards.html for updates and look forward to the second public comment period in 2020.

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Case Study: Female with abdominal pain after syncope

Jeremy T. Cushman, MD, MS, EMT-P, FACEP, FAEMS

Here's a "classic" case of a medical condition that I recently came across. I thought I would break it down to stimulate your differential diagnosis as well as provide an interesting

teaching point.

11:32 31C1 for the female who passed out, now awake, with abnormal breathing.

11:35 BLS arrives to find patient on kitchen floor in upstairs apartment. Patient is awake. BLS begins obtaining history and vitals. BLS is able to obtain pulse of 60, but no palpable blood pressure.

11:39 ALS arrives. Paraphrased from the nicely written HPI on the PCR: 27 yo female pt reports she started with spotty vaginal bleeding on Friday and on Saturday began to experience heavy bleeding that lasted until Tuesday night. Pt reports that on Tuesday she passed a large clot as well. Pt reports that since Tuesday night she has gone back to spotty bleeding. Pt c/o overall weakness, dizziness upon standing and diffuse 7/10 abd pain and decreased po intake. Pt also c/o intermittent nausea and vomiting. Pt denies any sob/ trouble breathing, chest pain/ discomfort or current n/v.

Before we go any further, what are you thinking? What is on your list of things that can be going on?

11:41 Assessment: Radial pulse present at 68, blood pressure 70/palp. Alert, oriented, abdominal pain with palpation in all quadrants. Remainder of exam unremarkable. IV established, fluids started, moved to ambulance, and transport begun.

Has your differential changed at all now that you have vitals and an exam?

12:22 Arrival at hospital. No change in clinical condition although HR 62, BP 86/51

So, let's remember the life threatening causes of syncope and abdominal pain. Female of child-bearing age with abdominal pain is what until proven otherwise? Ectopic pregnancy, of course! But she was having vaginal bleeding, you say, so it is a miscarriage and her continued vaginal bleeding caused her to have a low BP and pass out. Yes, it could be a miscarriage, and miscarriages often have some abdominal pain, but that is usually localized to the suprapubic area and is often referred to as cramping pain, and rarely presents as abdominal pain in all 4 quadrants. Blood loss is certainly the most likely cause of her dizziness, weakness and her syncope, but why then is her pulse only 60?

Here is the important teaching point: Interestingly, and for reasons not quite understood but likely related to stimulation of the vagus nerve, hemoperitoneum (blood in the abdomen) will often cause a relative bradycardia (relative, that is, to their blood pressure). Normally, with external hemorrhage, the lower our blood pressure, the higher our heart rate, as our body tries to compensate and maintain a constant cardiac output (remember that formula of Cardiac Output = Stroke Volume x Heart Rate?). This relative bradycardia is most commonly seen in individuals with ectopic pregnancy and many patients with intra-abdominal hemorrhage.

Shortly after her ED arrival, we had two large bore IV's in her and she was responding favorably to IV fluids with her BP improving to 90/50. She had tenderness throughout her abdomen with rebound and some involuntary guarding. A bedside ultrasound revealed an empty uterus and fluid (blood) around the ovaries and tracking as high up as Morrison's pouch (near the right kidney). The Obstetrics team was called shortly after her arrival and she went immediately to the OR where an ectopic pregnancy was confirmed in the left fallopian tube which had to be removed along with 550 ml of blood in the abdominal cavity. She was discharged that night.

There is little EMS (or even I in the ED) can do about a ruptured ectopic pregnancy EXCEPT have a high index of suspicion for it. Female with abdominal pain is always an ectopic until proven otherwise, and don't be fooled by hypotension without tachycardia.

(The Lack of) EMS Sleep and Wellness

by Andra Farcas, MD and Hashim Zaidi, MD

****This article first appeared on the Educational Blog of the National Association of EMS Physicians (NAEMSP) at http://www.naemsp-blog.com/browse-content ****

Is fatigue an expected work hazard for EMS providers? Based on experience from interacting with paramedics who make runs to the emergency department, it seems as if sleep on shift remains an uncommon occurrence. Many prehospital providers report getting little to no sleep in a 24 hour shift due to the high volume of calls in a busy urban EMS system and feel the consequences towards the end of the shift. Anecdotally, however, it seems as if they unanimously love the 24-hour shift structure and would only change the volume of runs they make in a shift. While subjective accounts are informative, we examined the literature to try to answer an important question: how does the lack of sleep and fatigue of a long shift affect EMS workers?

One of the most critical areas in which fatigue affects EMS workers is medical errors. One study found that fatigued EMS workers had 2.2 times greater odds of medical errors or adverse events compared to their non-fatigued colleagues, where fatigue was determined by self-reported surveys.[1]

This study also found that the number of shifts worked monthly was positively correlated to medical errors. Although performance is a difficult marker to measure in these types of studies, one surrogate marker has been psychomotor vigilance testing (PVT), which is a measure of behavioral alertness. One multisite cohort study performed PVT on EMS workers at the beginning and end of a shift and compared it by shift duration (24 hour shifts with shifts greater than 24 hours), as well as by time of shift. [2] They found no difference in PVT performance by shift duration but did find that performance was worse on night shift compared to day shift. They also found that performance increased as time from a nap to the test increased. For example, if prehospital personnel had napped in the hour before the test, they were more likely to do worse than if they had napped 3 hours before the test. The authors hypothesized this is likely due to sleep inertia, or grogginess upon waking.

Another equally important topic to consider is EMS worker safety. Fatigued EMS workers have a 1.9 greater odds of injury and 3.6 greater odds of safety-compromising behavior compared to their non-fatigued colleagues, but the number of shifts worked per month and longer shift hours (24 vs <12hrs) are not associated with higher odds of negative safety outcomes. [1] A longitudinal cohort study found that obese firefighters who didn't get enough sleep on shift were twice as likely to report having had an on-duty injury in the past 6-12 months than those who felt like they received enough sleep. [3] Interestingly, this was not significant in normal weight or even overweight firefighters.

Alongside worker safety, another area of importance that is often overlooked is EMS worker well-being. Occupational fatigue exhaustion recovery was found to be better for EMS workers who reported greater satisfaction with their schedule. [4] Interestingly, recovery was reported to be worst for EMS workers on

12 hour shifts and better for those who worked longer than 12 hour shifts, which the authors hypothesize could be related to a longer turnaround time between shifts for EMS workers who work longer hours. EMS worker well-being should matter to everyone, since these workers are critical to the functioning of our health system. One study found burnout prevalence among US EMS workers was as high as 38% and that the presence of burnout is associated with a 2-3 fold increase in likelihood to leave a job or leave the EMS profession.[5]

The literature summarized above quantifies for us what we already qualitatively knew is a growing problem. While intervention trials and high-quality studies to examine improvements to this issue are sparse, there are potential areas of improvement to be noted in the literature.

Evidence- based guidelines suggest 5 items that can be used for fatigue risk management in EMS workers [6]:

1. Decreasing shifts to less than 24 hours in length
2. Monitoring and measuring fatigue
3. Providing education and training about fatigue
4. Encouraging napping
5. Providing access to caffeine

The shift length question is certainly a highly contested one. Do 24 hour shifts need to be phased out? The existing evidence seems to point towards yes, but what is the ideal shift length? A systematic literature review found that shifts less than 24 hours in length are more favorable in terms of patient and personnel safety, although found that there was no difference the same outcome when considering 8 hour shifts vs 12 hour shifts.[7] An observational study found the risk of occupational injury and illness was lower in shifts 8 hours or less compared to longer shifts; shifts that were 16-24 hours in length had 60% greater risk of injury compared to shifts 8-12 hours in length.[8]

While it may seem counterintuitive that more training about fatigue would help with fatigue management instead of adding to the workload of an already tired EMS worker population, there is data to back it up. One randomized control trial tested the utility of fatigue interventions at end of shift and 120 days post shift. [9] Interventions were all done via text message and included recommendations in response to EMS worker self-rating their level of fatigue and quality of sleep. Recommendations were things like behavioral modifications to mitigate fatigue and weekly texts to encourage sleep. While the intervention group had no difference at 120 days from the control, they did have lower fatigue at the end of shift, indicating potential use in short-term fatigue management. Another study demonstrated that fatigue training in EMS workers was associated with improved patient and personal safety, lower ratings of acute fatigue, reduced stress and burnout, and improved sleep quality.[10] This training consisted of basic information on sleep, circadian rhythms, and sleep disorders, as well as the use of caffeine or nap strategies, optimization of sleep schedules or sleep environment, and practicing increased mindfulness. Another fairly manageable solution to improve on shift fatigue is structured napping. While napping may not drastically change reaction time, it is associated with decreased sleepiness at the end of shift. [11] Even though performance can be decreased soon after waking up from a nap [2], the evidence for the benefits of napping outweighs any detriments sleep inertia may cause.

While napping may not be feasible for many busy EMS units, caffeine has been explored as a potential substitute. One literature review found that in non-EMS shift workers, caffeine improved reaction time and PVT at the end of shift but with the caveat of, as expected, reducing sleep quality and duration. [12]

Shift fatigue continues to be a challenge for EMS shift workers but one potential solution may be sleep

banking. [13] This strategy involves extending sleep prior to scheduled shifts and may improve performance and acute fatigue.

The perceived benefits of shift work in emergency services have ensured it as a staffing model for decades to come in EMS and emergency medicine. The drawbacks, however, are prevalent and still not fully understood. Ensuring well rested and capable EMS workers will continue to be a challenge as long as shift work is preferred. More research is certainly needed and future robust studies looking at important topics such as shift length and on-shift interventions are essential. In the meantime, the literature suggests that while fatigue and sleepiness are real issues in EMS workers, some things that may help are education and training about fatigue, providing access to caffeine, and encouraging on shift napping if possible. While the shift length question remains contested, this is an informed discussion that needs to take place with EMS workers at the local level with the available understanding of the benefits and consequences of current staffing patterns.

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Local EMS Award Winner

Christopher Galton, MD, EMT-P

At the recent Air Medical Transport Conference in Atlanta, GA, Mercy Flight Central's Safety Officer, John Conceison, won a prestigious national award for advancing air medical safety. The ASTNA (Air & Surface Transport Nurses Association) awarded John the ***Lynn Steven's Excellence in Safety Award,*** for his continued efforts to improve the safety of every aspect of Mercy Flight Central's operations. The criteria for this award include:

1) Individual initiative promotes safety and improved the culture for a transport program or the transport community.

2) Individual steps above and beyond industry norms distinguishing themselves by implementation of an innovation, policy or practice centered on safety excellence.

What makes this award even more impressive is that it is a nursing organization that singled out a paramedic for his dedicated work to this pivotal but frequently overlooked part of our daily work. This was only the second time in the history of the organization that an award was given to someone outside the nursing profession.

Please join us all in congratulating John for achieving this milestone and for making the job safer for each and every one of us, every day.

An Evaluation of Prehospital Ketamine Use in Accordance with NYS EMS Collaborative Protocols

Emma Chee-How, Pharm.D., PGY-2 Emergency Medicine Pharmacy Resident

The use of ketamine has made a resurgence in emergency department (ED) and intensive care unit settings and as such has expanded into the prehospital setting. There are several potential indications for ketamine; management of pain, procedural sedation, rapid sequence intubation (RSI), post-intubation sedation, and more recently, excited delirium and agitation.[1-6] Ketamine is described as a "dissociative anesthetic" with analgesic and amnestic properties and a quick onset of action (IV ≤ 1 min; IM ≤ 5 min).[6,7]

In addition, it also maintains respiratory and cardiovascular stability and promotes bronchodilation, making it an extremely attractive treatment option.[5,6] These various effects are due to ketamine's multiple mechanisms of action, with the most notable being antagonism of N-methyl-D-aspartate (NMDA) receptors (sedation, dissociation), norepinephrine reuptake inhibition (tachycardia, hypertension), mu and kappa opioid-receptor agonism (analgesia) and beta-2 receptor agonism (bronchodilation).[7] Dosing depends on the route of administration (IV/IO, IM) and indication. Lower doses produce analgesia, while higher doses are needed for sedation and dissociation.

While ketamine has many attractive properties, adverse effects include tachycardia, hypertension, hypersalivation, nausea, vomiting, nystagmus, laryngospasm, apnea, hypoxia, and emergence reactions. Even though ketamine is known to maintain cardiovascular function, hypotension and bradycardia can also occur in catecholamine depleted patients. Ketamine cause calcium channel blockade but physiologic effects are usually masked by norepinephrine reuptake inhibition. When endogenous norepinephrine is depleted, negative inotropic effects may be seen physiologically.[9,10] Most concerning are the reported rates of intubation in the literature ranging from 15% to 63% when used for excited delirium (table 1).[11-13] Paramedics in New York State (NYS) can administer ketamine for management of pain, procedural sedation, RSI, post-intubation sedation, and excited delirium and agitation in accordance with NYS EMS Collaborative Protocols. With the varying doses between indications and rates of intubation reported in the literature, it is important to assess ketamine use to ensure efficacy and safety of both patients and EMS providers.

Study	Design	Intervention	Outcome
Keseg D et al. *Prehosp Emerg Care*. 2015.[12]	Retrospective chart review	Ketamine 4 mg/kg IM (± midazolam)	EMS reported clinical improvement: 32/35 (91%) Intubation: 8/35 (23%)
Cole JB et al. *Clin Toxicol*. 2016.[11]	Prospective, open-label	Ketamine 5 mg/kg IM vs. 10 mg IM haloperidol (± midazolam)	Median time (min) to sedation: 5 (0.4-23) vs. 17 (2-84) Intubation: 25/64 (39%) vs. 3/82 (4%)
Olives T et al. *Prehosp Disaster Med*. 2016.[13]	Retrospective chart review	Ketamine 5 mg/kg IM or 2 mg/kg IV/IO (± midazolam or haloperidol)	Intubation: 85/135 (63%)

We performed a retrospective review of 72 completed REDCap surveys of cases in which ketamine was administered by NYS EMS agencies and compared them to the current NYS EMS Collaborative Protocols for compliance with guideline recommendations and identification of adverse drug events (ADEs). The most common indications reported were RSI (40.3%) and excited delirium/agitation (31.9%). Of the 72 cases, 63 (87.5%) were appropriately dosed in accordance with the collaborative protocols (table 2). All cases of inappropriate dosing were above the protocol dose (see Table 2 on page 10).

Indication	NYS EMS Collaborative Protocol Dose	Case Dose, mg (mean ± SD)	Case Dose, mg/kg* (mean ± SD)	Appropriate Dose per Protocol, n (%)
RSI (n = 29)	IV: 2 mg/kg (max 500 mg)	158 ± 42	2.0 ± 0.3	25 (86.2%)
Excited Delirium (n = 23)^	IV: 0.5-2 mg/kg IM: 250 mg IM	IV: 100 ± 0 IM: 213 ± 63	IV: 1.4 ± 0.1 IM: 2.9 ± 1.2	22 (95.7%)
Pain (n = 15)&	IV: 25 mg or 0.1-0.3 mg/kg over 5 min IM: 50 mg	IV: 34 ± 24 IM: 37 ± 23	IV: 0.3 ± 0.2 IM: 0.4 ± 0.2	12 (80.0%)
Post-Intubation Sedation (n = 3)	IV: 1 mg/kg (max 100 mg) q15min prn	117 ± 76	1.4 ± 0.6	2 (66.7%)
Procedural Sedation (n = 1)	IV: 0.5-2 mg/kg IM: 3-5 mg/kg	IV: 50 mg (n =1)	IV: 0.5 (n = 1)	1 (100%)
Status Epilepticus (n = 1)	None	IM: 200 mg (n = 1)	IM: 2.9 (n = 1)	---

EMS: emergency medical services; NYS: New York State; RSI: rapid sequence intubation; SD: standard deviation.
**Dose calculated based on actual body weight since height was unknown to calculate ideal body weight.*
^ IV (n = 2), IM (n = 21). & IV (n = 12), IM (n = 3)

Ketamine has recently emerged as a treatment option for prehospital excited delirium/agitation and has shown to be superior to haloperidol in efficacy and time to adequate sedation at a dose of 5 mg/kg IM.[11] While the average dose administered in our review was much lower (likely due to the use of actual body weight instead of ideal body weight [IBW]), the average time to adequate sedation after ketamine administration was 6 ± 4 minutes, which is similar to previous studies.[11,12] In addition, patients did not require additional chemical sedation from EMS providers, indicating that ketamine, at these doses, provided not only quick, but efficacious control of excited delirium and agitation.

Both the prehospital and ED settings were reviewed for the occurrence of ADEs. Seven of 72 (9.7%) patients experienced 14 prehospital ADEs after receiving ketamine. The most common ADEs were hypoxia or apnea requiring basic life support (BLS) airway management (3 cases), cardiac arrest (3 cases), bradycardia (3 cases), and hypersalivation (2 cases) (figure 1). Forty patients who were transported to Strong Memorial Hospital or had information on ED ADEs provided in the REDCap survey were also reviewed. ADEs were more common in the ED setting compared to the prehospital setting, with 36 ADEs occurring in 25 (34.7%) patients. The most frequent ADEs in the ED were tachycardia (14 cases), hypotension (7 cases), bradycardia (4 cases) and hypoxia requiring intubation (3 cases) (figure 1).

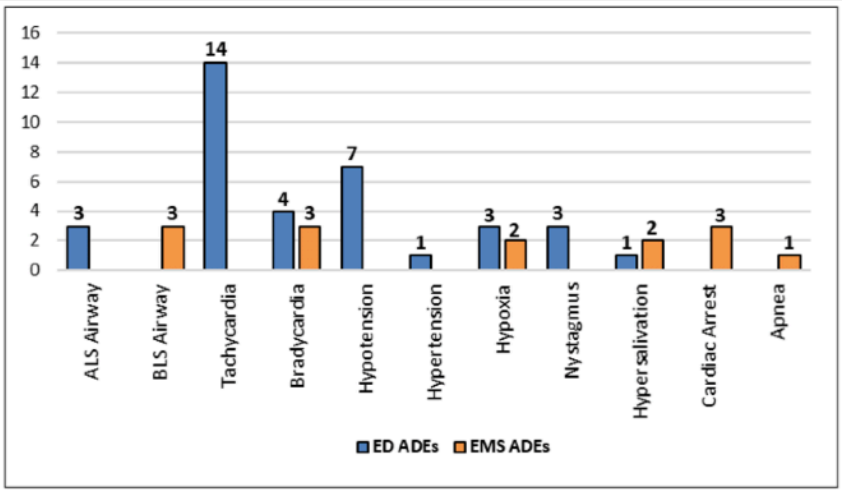

Figure 1: Adverse Drug Events (ADEs) by Setting

Three (4.2%) patients experienced cardiac arrest following the prehospital administration of ≥ 2 mg/kg IV ketamine for RSI (two patients above the recommended dose). All three patients experienced bradycardia, which further deteriorated to an initial rhythm of pulseless electrical activity. During the first case, cardiac arrest occurred 5 minutes after the administration of 2 mg/kg (160 mg) IV ketamine. Upon arrival to the ED, return of spontaneous circulation (ROSC) occurred and the patient was diagnosed with an ST-Elevation Myocardial Infarction (STEMI). Per review of prehospital records, a potential anterior STEMI was noted on the ECG prior to ketamine administration. The second case of cardiac arrest occurred after receiving 2.3 mg/kg (250 mg) IV ketamine. The patient was found to have sepsis secondary to pneumonia, which may have resulted in catecholamine depletion. The final case received 2.2 mg/kg (150 mg) IV ketamine prior to cardiac arrest, but resuscitation efforts were discontinued upon discovery of a "do not resuscitate" order. No additional serious ADEs were reported in patients receiving inappropriate doses. However, one additional patient received ketamine for RSI despite prehospital suspicion for STEMI with no consequent ADE.

With the exception of patients receiving ketamine for RSI, three (4.2%) patients required intubation in the ED after receiving appropriately dosed ketamine for excited delirium. These patients received a mean dose of ketamine IM 1.4 ± 0.5 mg/kg, a low dose compared to previous studies (4 to 5 mg/kg IM).[11-13] This dose may have been influenced by the statement in the excited delirium protocol advising caution when administering ketamine after midazolam, as all three patients received prior midazolam. A similar trend was noted in patients who required follow-up airway management in the prehospital setting. Among 11 patients who received prior midazolam, two required manual ventilation and three required a BLS airway after receiving ketamine. Unfortunately, current data on respiratory ADEs with ketamine is conflicting. One retrospective review of 5 mg/kg IM ketamine for excited delirium noted all three cases of respiratory depression (two requiring intubation) occurred in patients who also received midazolam 2.5 mg IV/IO, while another found that co-administration of midazolam 5 mg was not associated with intubation.[13,14] However, it is important to note that these midazolam doses are much smaller than the current NYS excited delirium collaborative protocol dose (10 mg IM).

Table 3: Ideal Body Weight (IBW)*

Height (in)	IBW Female (kg)	IBW Male (kg)
60	46	50
61	48	52
62	50	55
63	52	57
64	55	59
65	57	62
66	59	64
67	62	66
68	64	68
69	66	71
70	69	73
71	71	75
72	73	78
73	75	80
74	78	82
75	80	85
76	82	87
77	85	89
78	87	91
79	89	94
80	92	96

*IBW (M) = 50 + (2.3 × inches over 60);
IBW (F) = 45.5 + (2.3 × inches over 60)

While ketamine appears to be effective for numerous indications in the prehospital setting, it is important to identify the appropriate patient population for use, administer the most appropriate dose, and prepare for common adverse effects. Patient populations in which ketamine should be avoided include hypertensive patients in which increases in blood pressure would be detrimental, history of or suspicion for myocardial ischemia (e.g. STEMI), and those who may be catecholamine depleted (e.g. long-standing sepsis). While a majority of cases (87.5%) in our review were

appropriately dosed in accordance with the collaborative protocols, all inappropriate dosing was above the protocol dose. One contributing factor appeared to be dosing patients based on their estimated actual body weight due to difficulty estimating IBW, which is the most appropriate weight to use for dosing (table 3). Based on our review, midazolam may contribute to respiratory ADEs requiring intervention. However, based on both our review and published literature, ketamine monotherapy provides quick and efficacious sedation and therefore can be used as first line therapy without midazolam. We hope to use the results of this review to optimize the NYS collaborative protocols for ease of use for EMS providers and minimize adverse effects from ketamine use.

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