EM Advances

Do injection drug users have more adverse events during procedural sedation and analgesia for incision and drainage of cutaneous abscesses?

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ABSTRACT

Objective: Injection drug users (IDUs) often undergo procedural sedation and analgesia (PSA) in the emergency department (ED). We compared adverse events (AEs) for IDUs to those for non-IDUs receiving PSA for incision and drainage of cutaneous abscesses.

Methods: This was a retrospective analysis of a PSA safety audit. IDU status was prospectively documented among consecutive patients undergoing PSA at two urban EDs. Structured data describing comorbidities, vital signs, sedation regimens, and adverse events were collected. Primary outcome was the proportion of patients in each group experiencing an AE, whereas the secondary outcomes included recovery times.

Results: Of 525 consecutive patients receiving PSA for incision and drainage of an abscess, 244 were deemed IDUs and 281 non-IDUs. IDUs received higher doses of sedatives and analgesics, and 14 experienced AEs (5.7%), whereas 10 non-IDUs had AEs (3.6%), for a risk difference of 2.1% (95% CI −1.8, 6.5). Median recovery times were 18 minutes (interquartile range [IQR] 10–36) for IDUs and 12 minutes (IQR 7–19) for non-IDUs, for a difference of 6 minutes (95% CI 2–9 minutes). Median sedation times were also longer in IDUs, for a difference of 6 minutes (95% CI 5–10 minutes). Of 20 IDU patients and 1 non-IDU patient admitted to hospital, none had experienced an AE related to PSA.

Conclusions: For ED patients requiring PSA for incision and drainage, IDUs had an AE rate similar to that of non-IDUs but longer sedation and recovery times. In experienced hands, PSA may be as safe in IDUs as in patients who do not use injection drugs.

RÉSUMÉ

Objectif: Les utilisateurs de drogues injectables (UDI) subissent souvent des interventions sous sédation-analgésie (SA) aux services des urgences (SU). L'étude visait à comparer les événements indésirables (EI) de la SA chez les UDI avec ceux observés chez les non-UDI, pour l'incision et le drainage d'abcès cutanés.

Méthode: Il s'agit d'une analyse rétrospective d'une vérification sur l'innocuité de la SA. La situation d'UDI a été établie de manière prospective parmi des patients consécutifs ayant subi une SA dans deux SU urbains, et il y a eu collecte de données structurées sur les affections concomitantes, les signes vitaux, la posologie des sédatifs administrés, et les événements indésirables. Le principal critère d'évaluation était la proportion de patients dans chaque groupe qui avait éprouvé des EI, et les critères d'évaluation secondaires comprenaient, entre autres, le temps de réveil.

Résultats: Sur 525 patients consécutifs, ayant subi une SA pour l'incision et le drainage d'un abcès, 244 étaient considérés comme des UDI et 281, comme des non-UDI. Les UDI ont reçu des doses plus fortes de sédatifs et d'analgésiques, et 14 ont éprouvé des EI (5.7 %), tandis que 10 non-UDI ont connu des EI (3.6 %), soit une différence de risques de 2.1 % (IC à 95 % −1.8, 6.5). Pour ce qui est du temps médian de réveil, celui-ci était de 18 minutes (intervalle interquartile [II]: 10–36) chez les UDI contre 12 minutes (II: 7–19) chez les non-UDI, soit un écart de 6 minutes (IC à 95 % 2–9 minutes). Quant au temps médian de sédation, celui-ci était également plus long chez les UDI que chez les non-UDI, soit un écart de 6 minutes (IC à 95 % 5–10 minutes). Sur 20 UDI et 1 non-UDI hospitalisés, aucun n'a éprouvé d'EI lié à la SA.

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Conclusions: En ce qui concerne les patients traités aux SU et ayant subi une SA pour incision et drainage, les UDI avaient un taux d'EI comparable à celui des non-UDI; par contre, les temps de sédation et de réveil étaient plus longs chez les premiers que chez les seconds. Confiée à des praticiens chevronnés, la SA effectuée chez les UDI peut être aussi sûre que celle effectuée chez les non-UDI.

Keywords: infectious diseases, marginalized populations, pain management

Injection drug users (IDUs), an estimated 13 million persons worldwide, are predisposed to a variety of serious medical sequelae.[1] The emergency department (ED) is a common venue for treatment due to the often chaotic social circumstances of IDUs.[2,3] For example, the incision and drainage of cutaneous abscesses under procedural sedation and analgesia (PSA) is a typical ED procedure in hospitals serving a large population of IDUs.

IDUs are thought to have altered responses for both analgesics and sedatives compared to non-IDUs.[4–6] Long-standing substance misuse may sensitize patients to various anesthetic agents.[7,8] Peripheral intravenous access may be difficult[9] and pain tolerance may be decreased, requiring altered doses of analgesia.[10,11]

We compared dosing of sedative and analgesic medications, adverse event (AE) rates, and recovery times in IDUs and non-IDUs undergoing PSA for incision and drainage of cutaneous abscesses.

METHODS

Study design

This was a retrospective analysis of data that were prospectively collected for a regional safety audit on all patients undergoing PSA.

Study setting and population

The study was conducted at two urban sites in the Vancouver Coastal Health region and covered ED encounters from April 1, 2006, to January 31, 2009. St Paul's Hospital (site 1) is a tertiary care centre with an annual census of 60,000 ED visits, and Mount Saint Joseph's Hospital (site 2) is a community hospital with 30,000 ED visits per year. Both institutions are teaching centres affiliated with the University of British Columbia and are staffed by full-time emergency physicians, approximately one-quarter of whom work at both sites. Data collection was approved by the ethics committees of both institutions.

The two sites share an administrative database that captures all patient demographics, including mode of arrival, age, gender, address, chief complaint, and times of arrival and discharge. Hospital policy specifies that emergency physicians complete an electronic chart summary on all patients—composed of a list of all diagnoses and ED procedures—which is linked to the database. This database was interrogated by searching for the procedure codes of "procedural sedation" and "incision and drainage." We selected incision and drainage as this is a common procedure performed on both IDUs and non-IDUs. A previous similar audit of "procedural sedation" and "electrical cardioversion" demonstrated a physician coding accuracy of 99%.[12]

At both ED sites, each PSA was performed by the attending emergency physician. As per regional policy, physicians were assisted by registered nurses and respiratory therapists who were specially trained in ED PSA, and cardiac, noninvasive blood pressure, and pulse oximetry monitoring was mandatory. The attending physician alone selected the sedation regimen, including presedation opioids. The same physician performed the incision and drainage when the patient was deemed to have reached a sufficiently dissociated state or deep level of sedation.[13] Head, neck, trunk, and extremity abscesses were typically drained with patients in the supine position, whereas buttock, perianal, and ischiorectal abscesses were typically drained in the lateral decubitus position. Physicians individualized the use of local or regional anesthesia, postsedation analgesia, and follow-up.

Data collection

As part of a regional quality assurance program, all patients undergoing PSA had information recorded at the time of sedation on standardized data collection forms. The attending physician or nurse recorded patient comorbidities, IDU status (see below), body weight, American Society of Anesthesiologists' (ASA) risk score, and the last solid and liquid intake. All sedative and analgesic medications administered were

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recorded, along with dose and time. Vital signs were documented before the procedure, whenever a medication dose was administered, whenever an adverse event was deemed to have occurred by the treating physician, and every 5 minutes until physiologic recovery. AEs were documented according to regional guidelines by the attending physician or nurse on the data collection sheet and are described below under "Outcome measures."

As part of regional policy, the attending physician or registered nurse asked patients, prior to undergoing PSA, a standardized question: "Have you used injection drugs in the past month?" A similar approach has been used to identify IDUs entering the Vancouver Injection Drug Use Study since 1996.[14–16] Although self-reported illicit drug use appears to be accurate,[17] physicians and nurses used supporting evidence such as a previous history of injection drug use, recent abscesses, track marks, and clinical illicit drug intoxication to confirm or refute the patient's answer.

After the procedure, recovery was continuously supervised by the nurse and respiratory therapist, who recorded patient vital signs and activity every 5 minutes using a modified Aldrete scale.[18]

Data abstraction

We followed standards for medical record review, except that data abstractors were not blinded to study hypothesis.[19,20] Three trained emergency physician reviewers scrutinized the standardized data sheets and accompanying patient charts and recorded information directly into a specially prepared Microsoft *Excel* 2008 (Microsoft Corp, Redmond, WA) database. IDU status was recorded from the checkbox on the data sheet. When the status was not recorded or was incongruent with the clinical presentation (e.g., a patient who denied injection drug use but had a new antecubital fossa abscess), the electronic chart was reviewed to 1999—the start of electronic charting at our institutions—to ascertain status. If the status was still unclear, the case was adjudicated independently by an addictions medicine specialist and an infectious diseases specialist who were blinded to all other information. If they could not agree, the primary investigator determined the status.

All PSA medications administered, along with dose and time and vital signs at the start and finish of the procedure, were recorded. Any AEs noted by the treating physician were abstracted, along with vital signs and interventions.

Missing data sheet information was obtained when possible by reviewing the patient chart to 1999 (the start of electronic charting at our institutions). A random 10% of charts were independently abstracted by a second reviewer, and interobserver reliability scores calculated for IDU status and ambulance arrival. All patients having an AE were reviewed by a second emergency physician reviewer to ascertain whether an AE had taken place. Disputed, missing, and unclear chart information was resolved by consensus at regularly planned review meetings.

Outcome measures

The primary outcome was the proportion of patients having an AE in each group. AEs were defined by Vancouver Coastal Health regional PSA guidelines[21–23] and are explained in Table 1. AEs included airway obstruction, apnea, hypoxia; hypotension, recovery agitation (dysphoric behaviour, shouting, or agitation during or after recovery), myoclonus, and nausea or emesis. Other AEs included use of reversal agents, recovery time $>$ 3 hours, and PSA-related hospital admissions. A patient could have more than one AE;

Table 1. Adverse events

1. Respiratory
   a) Airway obstruction
   b) Apnea: cessation of respiration $>$ 20 s based on lack of chest wall motion and auscultation
   c) Hypoxia: oxygen saturation $<$ 90%
   d) Assisted ventilations: oral or nasal airway, bag-valve mask, noninvasive positive pressure ventilation, endotracheal intubation
2. Cardiovascular
   Hypotension with systolic blood pressure $<$ 100 mm Hg and requiring intravenous fluid bolus or vasoactive agents
3. Nervous system
   a) Recovery agitation requiring additional sedation
   b) Myoclonus
4. Gastrointestinal
   a) Nausea requiring antiemetics
   b) Emesis
5. Other
   a) Use of reversal agents
   b) Prolonged recovery time ($>$ 3 h)
   c) Unplanned admission
   d) Chest compressions
   e) Death

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for example, an apneic patient who was nauseated might receive an oral airway and an antiemetic.

Recovery time was measured by the Aldrete scale.[18] Once a patient reached a score of 8 of 10, he or she was deemed "recovered" from PSA. Secondary outcomes included recovery time (i.e., the difference between the administration of the last PSA medication and recovery), sedation time (i.e., difference between administration of the first PSA medication and recovery), and hospital admission.

Data analysis

Data are reported in terms of proportions or means and standard deviations; nonparametric data are summarized as medians and interquartile ranges (IQRs). A bootstrap method in *R* (version 2.13.1) was used to estimate confidence intervals for differences between medians. Scatterplots were generated with *Excel* 2008, and boxplots were generated using the default "boxplot" command in *R*.

RESULTS

Data were collected on 525 consecutive patients, of whom 244 were IDUs and 281 were non-IDUs. Patient weight was missing in 9% of cases and ASA classifications in 11%. Kappa values were 0.88 for IDU status and 0.90 for ambulance arrival. Nine patients required adjudication to determine IDU status. Table 2 compares presedation characteristics between the two groups. IDUs had higher rates of abnormal vital signs at baseline.

Table 3 classifies the sedation regimens as propofol alone, propofol/fentanyl, fentanyl/midazolam, and ketamine/propofol. IDUs received higher doses for all sedatives and analgesics, but significant differences were observed only for propofol dosing in the propofol-alone group and for fentanyl dosing in the fentanyl/midazolam group. Similar proportions of patients received preprocedural opioid analgesia.

AEs are summarized in Table 4. Among IDUs, 14 of 244 patients had AEs (5.7%, 95% CI 3.3–9.7), whereas 10 of 281 non-IDUs had AEs (3.6%, 95% CI 1.8–6.6), for a risk difference of 2.2% (95% CI –1.8, 6.5) No patient died or received chest compressions or endotracheal intubation. IDUs had greater rates of hypotension (1.2% versus 0.0%), recovery agitation (0.82% versus 0.0), and prolonged recovery time > 3 hours (1.2% versus 0.36%), but these differences were not statistically significant.

Table 5 details the 24 patients with AEs. Figure 1 displays the relationship between the cumulative dose of medication administered and AEs for each of the two-drug PSA regimens. No patient given propofol alone developed an AE. The majority of patients (13 of 24) with AEs had respiratory events, and 9 patients received reversal agents. Overall, 144 of 244 (59.0%) IDUs were opioid dependent and 8 of 14 IDUs (57.1%) with AEs used heroin. The 14 IDUs with AEs had a median recovery time of 59 minutes (IQR 35–182 minutes), whereas the 10 non-IDUs with AEs had a recovery time of 23 minutes (IQR 11–46 minutes).

Secondary outcomes are described in Table 6 and illustrated in Figure 2. Both recovery times and sedation times were on average 6 minutes longer in IDUs. Twenty IDUs and one non-IDU (who was homeless and used cocaine) were admitted to hospital. None of these 21 admitted patients had experienced an AE related to PSA.

DISCUSSION

In a consecutive series of patients receiving PSA for incision and drainage of cutaneous abscesses, IDUs had a 5.7% AE rate, whereas non-IDUs had a 3.6% AE rate, for a nonsignificant risk difference of 2.1%. Importantly, all AEs resolved with minimal interventions, and no patients died or had an unplanned admission related to sedation. IDUs were administered higher doses of sedative and analgesic medications than their non-IDU counterparts. Both recovery and sedation times were longer in the IDU group.

In theory, IDUs have a higher potential for sedation-related adverse events.[4–8] Chronic liver disease, poor nutrition, and decreased intravascular volume can lead to altered pharmacokinetics of sedatives and analgesics. Pre-ED use of opioids can predispose patients to respiratory depression during PSA, especially when combined with further sedatives. When used during PSA, ketamine increases heart rate and blood pressure and may potentiate the cardiac effects of cocaine.[24] Patients who misuse cocaine undergo pronounced changes in plasma endorphin levels and alterations in opioid mu and kappa receptors,[4,5,7] possibly resulting in abnormal pain perception and higher requirements for analgesics.[6] These features may in part account for higher

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Table 2. Baseline characteristics

Category	IDU (n = 244)	Non-IDU (n = 281)
Age, mean (SD)	36.5 (9.4)	40.8 (12.0)
Gender, n (% male)	146 (59.9)	219 (77.9)
Arrival by ambulance, n (%)	38 (15.5)	8 (2.9)
Site 1	244 (90.1)	212 (75.4)
Site 2	20 (9.9)	69 (24.6)
Vital signs at the start of procedures, mean (SD)		
Systolic blood pressure in mm Hg	120.4 (16.3)	126.9 (18.0)
Diastolic blood pressure in mm Hg	72.3 (11.1)	75.1 (10.6)
Heart rate in beats per minute	94.9 (15.9)	90.1 (16.2)
Respiratory rate in breaths per minute	18.9 (1.9)	18.2 (2.0)
Oxygen saturation in %	97.7 (1.5)	97.7 (1.5)
Temperature in degrees Celsius	37.1 (0.7)	36.9 (0.6)
Patients with abnormal vital signs at the start of procedures, n (%)		
Systolic blood pressure < 100 mm Hg	27 (11.1)	18 (6.4)
Diastolic blood pressure < 60 mm Hg	33 (13.5)	17 (6.0)
Heart rate > 100 beats per minute	96 (39.3)	63 (22.4)
Temperature > 37.5°C	54 (22.1)	27 (9.6)
Drugs of abuse, n (%)*		
Heroin	144 (59.0)	0 (0.0)
Cocaine	89 (36.4)	47 (16.7)
Amphetamines	29 (11.9)	11 (3.9)
Alcohol	10 (4.1)	12 (4.1)
Comorbidities, n (%)		
HIV	43 (17.7)	30 (10.7)
Hepatitis C	134 (54.9)	42 (14.9)
ASA class, n (%)		
1	151 (61.9)	177 (63.0)
2	64 (26.2)	67 (23.8)
3	1 (0.4)	6 (2.1)
4 or 5	0 (0.0)	0 (0.0)
Not recorded	28 (11.5)	31 (11.0)
ED opioid analgesia given < 30 min prior to PSA, n (%)	65 (26.7)	78 (27.8)
Morphine	58 (23.8)	49 (17.4)
Dose morphine, mg/kg, median (IQR)	0.07 (0.04–0.12)	0.10 (0.07–0.14)
Fentanyl	7 (2.9)	29 (10.4)
Dose fentanyl, μg/kg, median (IQR)	0.71 (0.58–0.89)	0.65 (0.54–0.72)
Abscess location, n (%)		
Trunk (abdomen/chest/back)	15 (6.2)	34 (12.1)
Head/neck	13 (5.3)	11 (3.9)
Buttocks/perianal/ischiorectal	33 (13.5)	130 (46.3)
Extremities	183 (75.0)	106 (37.7)

ASA = American Society of Anesthesiologists; ED = emergency department; HIV = human immunodeficiency virus; IDU = injection drug user; IQR = interquartile range.
*Many patients had polysubstance abuse.

cumulative doses of sedative and analgesics in the IDU group.

Despite these higher doses, the overall AE rate was comparable in both groups. Several factors may explain this result. Our patients may have received lower doses of sedatives and analgesics relative to their needs. All of the IDUs and some of the non-IDU group had substance misuse issues, and applying conventional dosing to this population may result in oligoanalgesia. Incision and drainage, which involves infiltration of an abscess with local anesthetic, incising the abscess, exploring and unroofing the abscess, and packing the resulting cavity, is a long, exquisitely painful procedure. It is possible that the noxious stimulation

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Table 3. Sedation regimens

Category	IDU (n = 244)	Non-IDU (n = 281)	% Difference (95% CI)*
Sedation regimens, n (%)			
Propofol	64 (26.2)	94 (33.4)	−7.2 (−15.0, 0.92)
Propofol/fentanyl	82 (33.6)	72 (25.6)	8.0 (0.11, 16.0)
Fentanyl/midazolam	56 (23.0)	60 (21.4)	1.6 (-5.7, 9.0)
Ketamine/propofol	42 (17.2)	55 (19.6)	−2.4 (−9.2, 4.6)
Sedation regimen doses, median (IQR)			
Propofol (mg/kg)	2.22 (1.51–2.99)	1.82 (1.33–2.26)	0.40 (0.26, 0.61)
Propofol (mg/kg)	2.11 (1.47–2.86)	1.96 (1.14–2.43)	0.15 (−0.10, 0.31)
Fentanyl (μg/kg)	1.31 (0.83–1.67)	1.23 (0.86–1.69)	0.08 (−0.19, 0.28)
Fentanyl (μg/kg)	3.10 (2.50–5.00)	2.44 (1.77–3.00)	0.66 (0.22, 1.25)
Midazolam (mg/kg)	0.05 (0.03–0.08)	0.04 (0.02–0.05)	0.01 (−0.01, 0.02)
Ketamine (mg/kg)	0.80 (0.47–1.00)	0.63 (0.44–0.84)	0.17 (−0.11, 0.40)
Propofol (mg/kg)	1.20 (0.87–1.54)	0.94 (0.58–1.20)	0.26 (−0.08, 0.50)

IDU = injection drug user; IQR = interquartile range.
*Wilson's continuity correction was employed.

provided by the procedure may have stimulated patients sufficiently to prevent hypotension or adverse respiratory events. Interestingly, IDUs who abused opioids did not appear to have a higher proportion of AEs than IDUs not abusing opioids.

As displayed in the scatterplots, higher doses of sedative and analgesics appeared to correlate with more AEs. More specifically, many AEs occurred when patients received beyond the 75th percentile dose for at least one of the medications, especially fentanyl when

Table 4. Overall summary of adverse events*

Category	IDU (n = 244), n (%, 95% CI)	Non-IDU (n = 281), n (%, 95% CI)	% Difference (95% CI)†
Adverse events			
Total number of patients with an AE	14 (5.7, 3.3–9.7)	10 (3.6, 1.0–6.6)	2.2 (−1.8, 6.5)
Total number of AEs	18 (7.4, 4.6–11.6)	15 (5.3, 3.2–8.8)	2.0 (−2.5, 6.8)
Respiratory			
Airway obstruction	0 (0.0, 0.0–1.2)	2 (0.71, 0.002–2.7)	−0.71 (−2.8, 1.3)
Apnea	2 (0.82, 0.03–3.1)	3 (1.1, 0.02–3.2)	−0.28 (−2.3, 2.6)
Hypoxia	3 (1.2, 0.03–3.7)	3 (1.1, 0.02–3.2)	0.10 (−1.7, 3.5)
Cardiovascular			
Hypotension	3 (1.2, 0.03–3.7)	0 (0.0, 0.0–1.1)	1.2 (−0.7, 3.9)
Nervous system			
Recovery agitation	2 (0.82, 0.03–3.1)	0 (0.0, 0.0–1.1)	0.82 (−1.0, 2.3)
Myoclonus	0 (0.0, 0.0–1.2)	0 (0.0, 0.0–1.1)	0.01 (−1.7, 1.9)
Gastrointestinal			
Nausea	0 (0.0, 0.0–1.2)	1 (0.36, 0.001–2.2)	−0.4 (−2.3, 1.6)
Emesis	1 (0.41, 0.001–2.5)	0 (0.0, 0.0–1.1)	0.4 (−1.6, 2.3)
Other			
Use of reversal agent	4 (1.6, 0.05–4.3)	5 (1.8, 0.2–3.3)	−0.19 (−2.9, 2.9)
Prolonged recovery time	3 (1.2, 0.03–3.7)	1 (0.36, 0.001–2.2)	0.83 (−1.7, 3.5)
Unplanned admission	0 (0.0, 0.0–1.2)	0 (0.0, 0.0–1.1)	0.01 (−1.7, 1.9)
Chest compressions	0 (0.0, 0.0–1.2)	0 (0.0, 0.0–1.1)	0.01 (−1.7, 1.9)
Death	0 (0.0, 0.0–1.2)	0 (0.0, 0.0–1.1)	0.01 (−1.7, 1.9)

AE = adverse event; IDU = injection drug user.
*See Table 1 for definitions of adverse events.
†Wilson's continuity corrrection was applied.

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Table 5. Detailed description of adverse events (IDUs = 244; non-IDUs = 281)

Age (yr), Sex, IDU/ non-IDU status	Patient opioid use	Abscess location	Weight (kg)	Pre-PSA med	Med1	Med 2	Description of adverse event with vital signs	Intervention	Recovery (min)
Respiratory									
35, M, IDU*	No	Perianal	136	None	F 150 μg	M 2 mg	Hypoxia: initial O_2 97%, nadir O_2 79%	Naloxone 0.4 mg, BVM × 1 min	36
36, M, IDU	No	Arm	70	None	P 330 mg	F 150 μg	Hypoxia, initial O_2 100%, nadir O_2 75%	BVM × 2 min	33
41, M, IDU*	Yes	Leg	70	Mor 5	F 350 μg	M 5 mg	Apnea: initial O_2 99%, nadir O_2 93%	Flumazenil 0.1 mg	26
27, M, IDU*	Yes	Hand	77	Mor 5	F 500 μg	M 4 mg	Apnea: initial O_2 99%, nadir O_2 90%	Flumazenil 0.1 mg	35
31, F, IDU*	Yes	Arm	68	None	P 50 mg	F 50 μg	Apnea: initial O_2 98%, nadir O_2 91%	Naloxone 0.2 mg	73
51, M, non-IDU	No	Hand	89	None	P 200 mg	F 175 μg	Hypoxia: initial O_2 98%, nadir O_2 84%,	Oral airway × 2 min	45
35, M, non-IDU*	No	Buttock	136	None	F 200 μg	M 2 mg	Hypoxia: initial O_2 98%, nadir O_2 78%	Naloxone 0.4 mg, oral airway × 1 min	47
64, F, non-IDU*	No	Perianal	84	None	F 250 μg	M 3 mg	Hypoxia: initial O_2 98%, nadir O_2 75%	Naloxone 0.4 mg, BVM × 2 min	4
24, M, non-IDU*	No	Buttock	70	None	F 250 μg	M 5 mg	Apnea: initial O_2 99%, nadir O_2 80%	Naloxone 0.2 mg	20
29, M, non-IDU*	No	Leg	89	None	F 100 μg	M 4 mg	Apnea: initial O_2 99%, nadir O_2 91%	Naloxone 0.2 mg	12
47, M, non-IDU*	No	Abdomen	84	None	F 350 μg	M 6 mg	Apnea: initial O_2 98%, nadir O_2 90%	Naloxone 0.4 mg	9
49, M, non-IDU	No	Leg	141	None	F 250 μg	M 3 mg	Partial airway obstruction	Airway positioning	14
67, M, non-IDU	No	Buttock	120	Mor 5	P 100 mg	F 250 μg	Partial airway obstruction	Airway positioning	25
Cardiovascular									
48, M, IDU	No	Arm	70	None	P 240 mg	F 75 μg	Hypotension: initial BP 105/60 mm Hg, nadir BP 85/50 mm Hg	NS 1 L bolus	28
31, F, IDU	Yes	Leg	55	None	F 500 μg	M 4	Hypotension: initial BP 104/76 mm Hg, nadir BP 78/55 mm Hg	NS 500 cc bolus	104
36, F, IDU	Yes	Buttock	56	Mor 3	P 340 mg	F 75 μg	Hypotension: initial BP 92/58 mm Hg, nadir BP 70/50 mm Hg	NS 1 L bolus	158
Nervous system									
31, F, IDU	No	Arm	68	None	K 50 mg	P 50 mg	Recovery agitation; unpleasant reaction	M 5 mg IV	73
58, F, IDU	No	Leg	86	None	K 40 mg	P 40 mg	Recovery agitation; yelling	M 2 mg IV	35

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Table 5. Continued

Age (yr), Sex, IDU/ non-IDU status	Patient opioid use	Abscess location	Weight (kg)	Pre-PSA med	Med1	Med 2	Description of adverse event with vital signs	Intervention	Recovery (min)
Other									
26, F, IDU	Yes	Arm	43	None	K 40 mg	P 60 mg	Emesis	Metoclopramide 10 mg IV	50
33, F, non-IDU	No	Leg	45	None	F 100 μg	M 2 mg	Nausea	Dimenhydrinate 25 mg IV	30
27, F, IDU	Yes	Arm	59	Mor 5	F 50 μg	M 5 mg	Recovery time > 3 h	None	219
26, M, IDU	No	Arm	71	None	K 40 mg	P 20 mg	Recovery time > 3 h	None	255
26, F, IDU	Yes	Arm	68	None	P 100 mg	F 50 μg	Recovery time > 3 h	None	205
51, M, non-IDU	No	Arm	70	None	F 250 μg	M 4 mg	Recovery time > 3 h	None	190

BP = blood pressure; BVM = bag-valve mask; F = fentanyl; IDU = injection drug user; K = ketamine; M = midazolam; Mor = morphine; NS = normal saline; O_2 = oxygen saturation; P = propofol; Pre-PSA med = parenteral opioid given within 30 minutes of starting sedation; Med 1, Med 2 = medications administered during procedural sedation and analgesia.
*Each patient had two adverse events.

coadministered with either propofol or midazolam. AEs in patients receiving ketamine/propofol or propofol alone were not strongly influenced by dose. However, the small number of AEs and nonrandom assignment preclude drawing firm conclusions regarding the relative safety of the sedating regimens.

Rapid recovery promotes patient safety and reduces ED resource use. The 18-minute IDU recovery time was 6 minutes longer than the non-IDU recovery period. This could be due to the greater amounts of sedative and analgesic medications received by the IDU group or reflect the pre-existing acute and chronic health problems observed in that group. Despite eventually being discharged from the ED, patients experiencing AEs had substantially longer median recovery times—59 minutes in the IDU group (versus 18 minutes for the overall IDU group) and 20 minutes (versus 12 minutes in the non-IDU group)—again suggesting a relationship with excessive dosing.

Nine patients were administered reversal agents. Use of flumazenil or naloxone, although causing a patient to "recover" quickly from PSA, may also precipitate rapid opioid or benzodiazepine withdrawal. Many patients depend on these medications, and use of reversal agents that could lead to agitation, seizures, or emesis should be carefully considered.

LIMITATIONS

Although the physicians, nurses, and respiratory therapists who recorded the data all underwent PSA and documentation training, there was no independent data quality control during the study period. The physicians and nurses who completed data sheets were aware of IDU status, as were the reviewers, and AEs may have been misclassified. The IDU status may be problematic: a patient who used injection drugs once in the past month may be less prone to AEs than someone who inhaled cocaine on a daily basis.

Patient self-administration of drugs, including opioids, prior to attending the ED was not recorded. Weight-adjusted dosing could be estimated only for the 9% of patients who did not have weights recorded. Willingness to administer PSA, incision and drainage, and the choice and dosing of sedatives and analgesics was entirely at the discretion of the treating physician. Variability in the selection, dosing, and timing of medications could reflect that physician's experience and/or bias in this patient population. Adjuvant use of local or regional anesthesia was individualized but not consistently recorded.

Some AEs, especially minor airway readjustments, may not have been documented. Capnography was not mandated in our region until after the study was completed. Measuring carbon dioxide partial pressure could have increased both interventions and reported AEs.[25–27] Sedation effectiveness and patient and staff satisfaction scores were not obtained.

CONCLUSION

For ED patients undergoing PSA for incision and drainage, IDUs had a rate of AEs similar to that of

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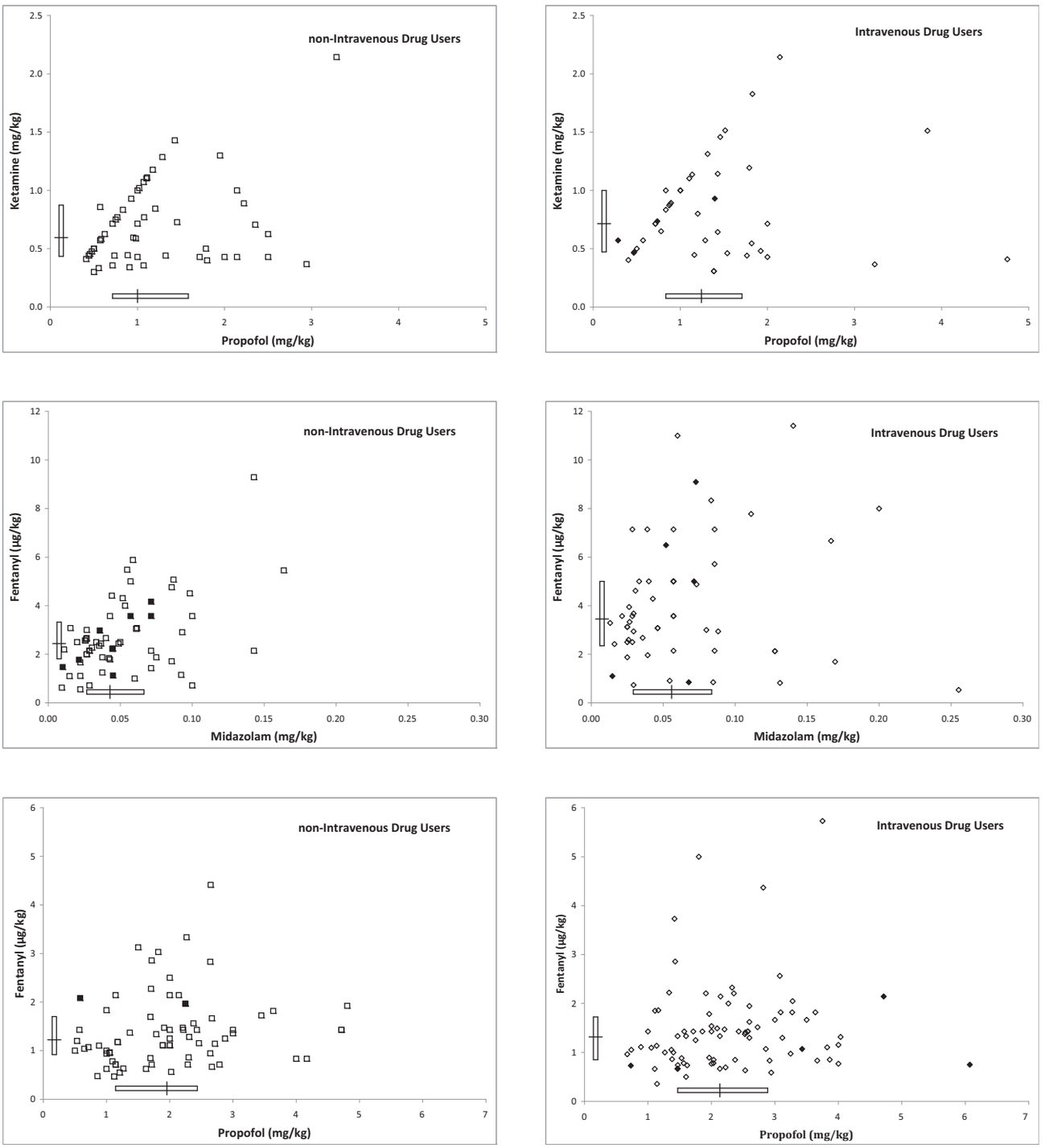

Figure 1. Adverse events by sedating regimen for injection drug users and non–injection drug users. Cumulative drug dose per patient weight administered during the entire procedure is shown. *Filled symbols* represent the patients experiencing an adverse event; *open symbols* represent the rest. The *rectangle* along each axis spans the 25th to 75th percentile, whereas the *bar* indicates the median. A patient weight of 70 kg was used for the 9% of patients in whom weight was not recorded.

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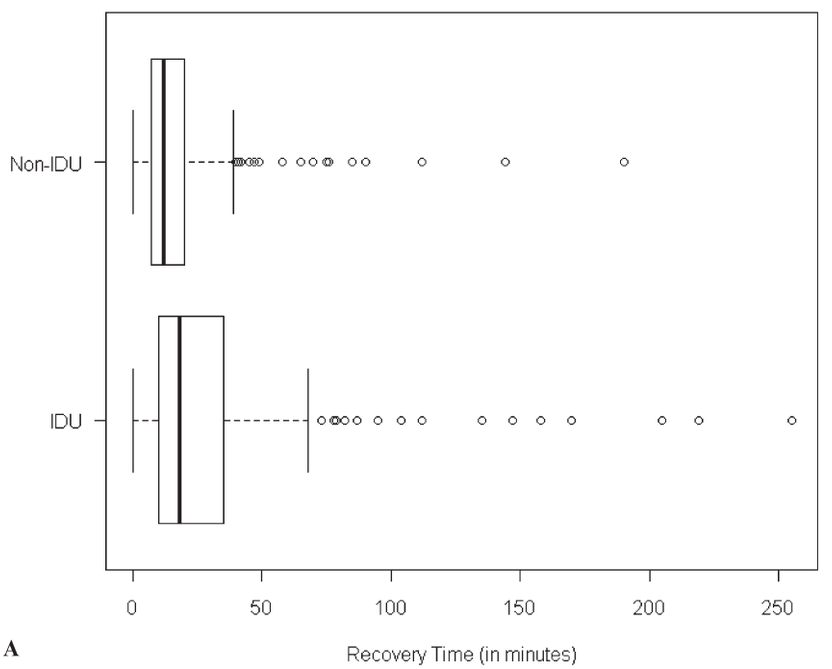
Table 6. Secondary outcomes

Category	IDU (n = 244)	Non-IDU (n = 281)	% difference (95% CI)*
Times (median, IQR)			
Recovery time (min)	18 (10, 36)	12 (7, 19)	6 (2–9)
Sedation time (min)	25 (17, 45)	19 (14,25)	6 (5–10)
ED disposition			
Admitted to hospital, n (%)	20 (8.2)	1 (0.4)	7.8 (4.3–12.2)

ED = emergency department; IDU = injection drug use; IQR = interquartile range.
*For differences between proportions, Wilson's continuity correction was employed.



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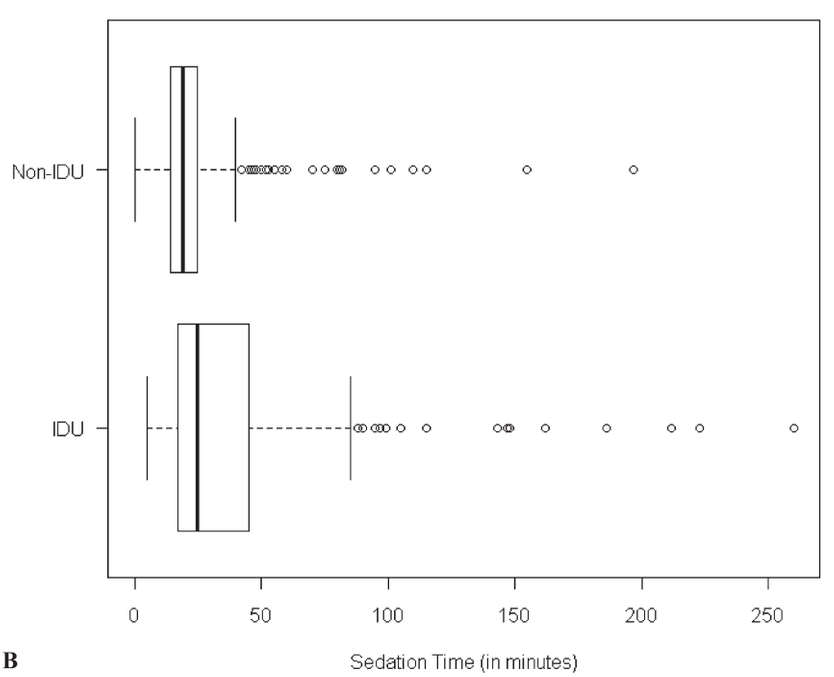

B

Figure 2. *A*, Recovery time (time from last administration of sedative/analgesic drug until physiologic recovery) for injection drug users (IDUs) and non-IDUs. *B*, Sedation time (time from first administration of sedative/analgesic drug to physiologic recovery) for IDUs and non-IDUs.

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non-IDUs but longer recovery times. When performed by experienced physicians, PSA may be as safe for this group of patients as for patients who do not use injection drugs.

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