Evaluation of pain management in medical transfer of trauma patients by air

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CLINICIAN'S CAPSULE

What is known about the topic?
Pain management provided by transport personnel is pivotal, yet most analgesia administration studies have been conducted in land ambulance services
What did this study ask?
What are the pain management practices of critical care paramedics when transferring trauma patients by air transport services in Ontario?
What did this study find?
Analgesia doses had minimal effect on pain ratings, due in part to inadequate dosing and a long time interval between doses
Why does this study matter to clinicians?
Reasons for oligoanalgesia remain unclear, so an opportunity exists to improve the management of acute pain in this patient population.

ABSTRACT

Objectives: With regionalized trauma care, medical transport times can be prolonged, requiring paramedics to manage patient care and symptoms. Our objective was to evaluate pain management during air transport of trauma patients.
Methods: We conducted a 12-month review of electronic paramedic records from a provincial critical care transport agency. Patients were included if they were ≥18 years old and underwent air transport to a trauma centre, and excluded if they were Glasgow Coma Scale score <14, intubated, or accompanied by a physician or nurse. Demographics, injury description, and transportation parameters were recorded. Outcomes included pain assessment via 11-point numerical rating scale, patterns of analgesia administration, and analgesia-related adverse events. Results were reported as mean ± standard deviation, [range], (percentage).

Results: We included 372 patients: 47.0 years old; 262 males; 361 blunt injuries. Transport duration was 82.4 ± 46.3 minutes. In 232 (62.4%) patients who received analgesia, baseline numerical rating scale was 5.9 ± 2.5. Fentanyl was most commonly administered at 44.3 [25–60] mcg. Numerical rating scale after first analgesia dose decreased by 1.1 [-2–7]. Thereafter, 171 (73.7%) patients received 2.4 [1-18] additional doses. While 44 (23.4%) patients had no change in numerical rating scale after first analgesia dose, subsequent doses resulted in no change in numerical rating scale in over 65% of patients. There were 43 adverse events recorded, with nausea the most commonly reported (39.5%).
Conclusions: Initial and subsequent dose(s) of analgesic had minimal effect on pain as assessed via numerical rating scale, likely due in part to inadequate dosing. Future research is required to determine and address the barriers to proper analgesia.

RÉSUMÉ

Objectif: Compte tenu de la régionalisation des soins en traumatologie, la durée des transports pour raison médicale peut être prolongée, ce qui oblige les ambulanciers paramédicaux à traiter les symptômes et à donner des soins. L'étude visait donc à évaluer le soulagement de la douleur durant le transport aérien des polytraumatisés.
Méthode: L'étude consistait en un examen de dossiers électroniques d'ambulanciers paramédicaux, provenant d'une agence provinciale de transport de blessés en phase critique, sur une période de 12 mois. Les critères d'inclusion comprenaient un âge ≥ 18 ans et le transport aérien vers un centre de traumatologie; et les critères d'exclusion, un score < 14 sur l'échelle de Glasgow, l'intubation ou l'accompagnement d'un médecin ou d'une infirmière. La collecte d'éléments factuels se composait de données démographiques, de renseignements sur les blessures et de paramètres relatifs au transport. Les résultats étudiés comprenaient l'évaluation

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de la douleur sur une échelle numérique de 11 points, les modes d'administration des analgésiques et les événements indésirables liés à l'analgésie. Les résultats sont exprimés sous forme de moyenne ± l'écart type [fourchette], (pourcentage).

Résultats: Ont été retenus dans l'étude 372 patients : âge : 47,0 ans; hommes : 262; contusions : 361. La durée de transport était de 82,4 ± 46,3 minutes. Parmi les 232 patients (62,4%) qui ont reçu des analgésiques, la douleur au départ s'élevait à 5,9 ± 2,5 sur l'échelle numérique. Le médicament le plus souvent administré était le fentanyl, à raison de 44,3 μg [25–60]. Une diminution de l'intensité de la douleur de 1,1 [-2–7] sur l'échelle numérique a été enregistrée après la première dose d'analgésique; par la suite, 171 patients (73,7%) ont reçu 2,4 doses additionnelles [1–18]. De leur côté, 44 patients (23,4%) n'ont noté aucun changement sur l'échelle numérique après la première dose d'analgésique, et les doses suivantes n'ont rien changé à l'évaluation de la douleur chez plus de 65% des patients. Enfin, 43 événements indésirables ont été enregistrés, dont le plus fréquent était les nausées (39,5%).

Conclusions: Les doses initiales et subséquentes d'analgésiques ont eu peu d'effets sur le soulagement de la douleur, selon l'évaluation faite sur l'échelle numérique, probablement en raison d'un dosage inadéquat, du moins en partie. Aussi faudrait-il mener des études sur les obstacles à l'administration d'une analgésie appropriée et sur la manière de les vaincre.

INTRODUCTION

Trauma systems are created based on the regionalization of care to improve patient outcomes in a cost-effective manner.[1,2] As a consequence, medical transport services are necessary for patient transfers to these designated regional trauma centres. Depending upon the proximity of the closest centre, air medical transport services are often required to cover large distances. Consequently, air medical personnel must, therefore, provide care to these trauma patients for a significant period of time.

A pivotal aspect of care provided by air medical personnel relates to pain management, as emphasized by previous position statements, reports, and guidelines.[3,4,5] Pain is frequently undertreated during medical transport.[6,7,8,9] Two studies noted that patients are more likely to receive pain relief in the context of chest pain or suspected acute myocardial infarction than after having suffered trauma.[10,11] Unfortunately, oligoanalgesia in trauma can have many long-term sequelae including chronic pain.[12,13,14] Identification of these types of shortcomings is important for the development and implementation of initiatives and guidelines to facilitate administration of adequate analgesia moving forward.[15,16]

The majority of studies involving an examination of the adequacy of analgesia administered have been conducted in land ambulance services. There is a gap in the literature with regards to evaluating pain management following trauma in the setting of air medical transport services, particularly those transported exclusively by paramedics.[8,17] Whether there is any difference from an analgesia perspective in patients transported by land or air or whether land and air medical personnel would act any differently during patient transportation is difficult to ascertain and has not yet been rigorously studied. Possible factors affecting analgesia in patients transported by air compared with those by land could be a longer transport duration and greater severity of the injury, as denoted by a higher injury severity score.[18]

The primary objective of this study was to evaluate the pain management practices of Ornge (Ontario's provincial air and land critical care transport service) during the transportation of trauma patients by air. Our aim was not to test any specific hypotheses or analyze for associative factors, but rather to describe current practices to guide future research projects on improving the adequacy of analgesia administration.

METHODS

Study design and time period

We conducted a 12-month health record review of Ornge electronic paramedic records. We screened cases from January 1, 2015, to December 31, 2015.

Study setting

Ontario is a large Canadian province (approximately 1.1 million km^2 or 424,600 miles^2) with a mix of urban, suburban, rural, and remote areas. The health care system is publicly funded and serves a population of approximately

13.5 million people. Ornge Transport Medicine is the publicly funded air medical transport system providing all air medical patient transfers in Ontario. Ornge is Canada's single largest air medical transport provider, carrying out approximately 19,000 patient transports annually.

Ornge operates its own dedicated communication and dispatch centre and utilizes a dedicated medical decision algorithm to determine patient acuity and call priority. The centre also has a medical control physician, dedicated to providing full-time medical control without any other competing clinical duties. Medical control physicians are board certified in emergency medicine and have an extensive prehospital care or transport medicine background. Physicians also provide indirect medical control, providing medical oversight to the service's quality care, investigation, pharmacy and therapeutics, and education committees.

Ornge aircraft operate as either advanced or basic life support aircraft, with flight paramedics as the sole providers during transport. The scope of practice for the highest crew designation, critical care, is consistent with the National Occupational Competency Profile and includes management of patients who require intubation, mechanical ventilation, use of inotropes or vasopressors, administration of fibrinolytic agents, and maintenance of intra-aortic balloon-pump therapy without additional medical personnel. Flight paramedics provide care using standing orders and medical directives developed by the Ornge Medical Advisory Committee and contact medical control physicians when the care exceeds these orders or directives.

Population

The Ornge patient care record system was queried to identify potentially eligible patients. Patients were included if they were ≥18 years old, sustained multisystem traumatic injuries, and were undergoing air transport to a designated trauma centre by Ornge either directly from the scene or a primary receiving (non-trauma) hospital. Patients were excluded if they were <18 years old, had a Glasgow Coma Scale (GCS) score <14, required intubation, or were accompanied by a hospital-based staff (such as a nurse or physician).

The study was approved by the Research Ethics Board of Sunnybrook Research Institute and the Ottawa Health Science Network Research Ethics Board.

Data collection

Information was abstracted from the electronic patient care records of included patients in a standardized, piloted data collection form by a single trained data extractor. To confirm the accuracy of the data collection, a second reviewer abstracted data randomly from 10% of the selected records. Any differences were to be discussed to resolve data abstraction issues. All data abstracted using data collection forms were subsequently entered into a spreadsheet (Microsoft Excel; Microsoft Corporation, Redmond, WA, USA) to facilitate suitable data analyses.

Outcome measures

Patient demographic information collected included: age, sex, weight, medical comorbidities, medications, allergies, GCS score, and initial vital signs (heart rate, respiratory rate, blood pressure, and oxygen saturation).

Information collected regarding injury and transportation details included: type of trauma (blunt versus penetrating), mechanism of injury, injury location, pre-transportation analgesia, sending location, transfer duration, and general care received during transport (e.g., intravenous insertion, immobilization, etc.).

Outcomes measures that were selected included: medication administration (analgesia administered or not; time to first analgesia from departure of scene or receiving hospital; type of analgesia; analgesia dose and route; frequency of analgesia re-administration); pain management (comparison of initial and repeat pain assessments using a 11-point numerical rating scale related to administration of analgesia medication); and adverse events (rates of adverse events related to the total administration of analgesia medication).

Data analysis

We used descriptive statistics to report results as mean ± standard deviation, range, and percentage. Pain management, analyzed according to absolute differences in numerical rating scale pain assessments following administration of analgesia medication, was reported as the mean numerical rating scale differences between doses and also the number of patients experiencing numerical rating scale differences equal to zero (i.e., no change in numerical rating scale pain assessment from baseline to first dose of analgesia; from first dose to second dose; from second dose to third dose etc.).

Sample size

The sample size for this health record review was dictated by the number of patients eligible for inclusion over an entire consecutive calendar year. Use of a consecutive calendar year removed the potential for biases in seasonal variations present based on time of year.

RESULTS

During the one-year study period, 600 potential patients were identified, with a total of 372 patients meeting the eligibility criteria (Figure 1). No issues were identified between the two reviewers (i.e., 100% agreement) in relation to data abstraction. Patient characteristics for the included cases are presented in Table 1. Patients were 46.9 (range 19–92) years old, 262 (70.4%) were male, mean weight was 85.8 kg (range 40–242) kg, 11 (5.7%) had chronic pain, and 134 (36.0%) were taking any medications.

Table 2 summarizes injury, patient care, and transportation details. There were 361 (97.0%) patients who sustained a blunt injury, and 11 (3.0%) sustained a penetrating injury. Motor vehicle collision was the most common mechanism of injury (34.1%), with extremities being the most affected injury location (68.3%), followed by the head (43.5%). Duration of transport was 82.4 ± 46.3 minutes. Approximately two-thirds of all patients underwent spinal immobilization (66.4%) or received intravenous fluids (62.6%) during transportation.

The pain was initially assessed in 335 (90%) patients (Table 3). Overall, the numerical rating scale at baseline was 4.9 ± 2.8. For the 232 (62.4%) patients who received analgesia, the numerical rating scale at baseline was 5.9 ± 2.5, compared with 3.1 ± 2.5 in patients who did not

receive analgesia. Fentanyl was the most commonly administered first dose of analgesia in 181 (78.5%) patients, with a mean dose of 44.3 (range 25–60) mcg. The numerical rating scale assessed in 81% of patients after the first dose of analgesia decreased by 1.1 ± 1.6 points (range −2 to 7). There were 44 (23.4%) patients who had no change in numerical rating scale from baseline after the first dose of analgesia.

A total of 171 (73.7%) patients received further analgesia, equal to 2.4 ± 2.0 (range 1–18) additional doses (Table 4). Fentanyl was again the most commonly administered analgesic across the second to nineteenth doses. Subsequent doses of analgesia resulted in no change in the numerical rating scale in over 65% of patients (range 65.4–71.3).

Table 5 outlines the adverse events recorded. Thirty-two patients experienced a total of 43 adverse events after a total of 638 doses of analgesia. Nausea occurred most often (39.5%), and oxygen desaturation was the most common physiologic derangement (28.0%). Nearly one-half of all the adverse events recorded (48.8%) occurred after the first dose of analgesia.
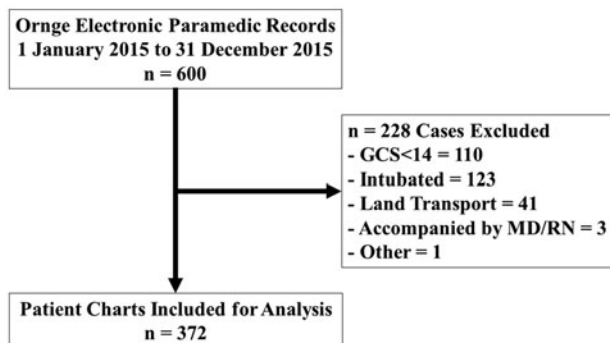

Figure 1. Study patient flow.

Table 1. Patient characteristics ($N = 372$)	
Characteristics	Descriptive statistic
Age in years, mean ± SD [range]	46.9 ± 17.4 [19–92]
Sex	
Male, n (%)	262 (70.4)
Weight in kg, mean ± SD [range]	85.8 ± 20.5 [40–242]
Comorbidities, $n = 193$; n (%)	
Hypertension	57 (29.5)
Diabetes	33 (17.1)
Respiratory disease	26 (13.5)
Coronary artery disease	16 (8.3)
Chronic pain	11 (5.7)
Peripheral vascular disease	1 (0.5)
Other*	142 (73.6)
Taking any medications, n (%)	134 (36.0)
Allergies to medications, n (%)	68 (18.3)
Initial vital signs	
Systolic blood pressure, mean ± SD [range]	131.9 ± 23.8 [60–245]
Diastolic blood pressure, mean ± SD [range]	80.3 ± 21.4 [0–214]
Heart rate, mean ± SD [range]	89.7 ± 18.8 [16–145]
Respiratory rate, mean ± SD [range]	19.4 ± 4.3 [9–37]
Oxygen saturation, mean ± SD [range]	97.1 ± 3.1 [80–100]
GCS, mean ± SD	14.9 ± 0.4

GCS = Glasgow Coma Scale; SD = standard deviation.
*"Other" represents a multitude of otherwise infrequent separate medical conditions.

Table 2. Injury and transportation details	
Characteristics	Descriptive statistic
Type of injury, *n* (%)	
Blunt	361 (97.0)
Penetrating	11 (3.0)
Mechanism of injury, *n* (%)	
MVC	127 (34.1)
Fall from height	66 (17.7)
ATV collision	40 (10.8)
Motorcycle collision	39 (10.5)
Crush	28 (7.5)
Burns	20 (5.4)
Pedestrian v. MVC	19 (5.1)
Assault	9 (2.4)
Stabbing	8 (2.2)
GSW	4 (1.1)
Other	12 (3.2)
Injury location, *n* (%)	
Extremities	254 (68.3)
Head	162 (43.5)
Thorax	144 (38.7)
Spine	125 (33.6)
Abdomen	88 (23.7)
Pelvis	82 (22.0)
Pre-transport analgesia, *n* (%)	187 (50.3)
Sending location, *n* (%)	
Interfacility transfer	154 (41.4)
Modified scene	114 (30.6)
Scene	104 (28.0)
Duration of transfer in minutes, mean ± SD [range]	82.4 ± 46.4 [16–272]
Care received during transport, *n* (%)	
Spinal immobilization	247 (66.4)
Intravenous fluids	233 (62.6)
IV insertion	88 (23.7)
Dressing applied/changed	18 (4.8)
Any blood products administered	16 (4.3)
IO insertion	5 (1.3)
Chest tube insertion/needle decompression	3 (0.8)
Vasopressors administered	2 (0.5)

ATV = all-terrain vehicle; GSW = gun shot wound; IO = intraosseous; IV = intravenous; MVC = motor vehicle collision; SD = standard deviation.
*"Other" represents a multitude of otherwise infrequent separate mechanisms of injury.

Table 3. Pain and analgesia data for the first dose	
Characteristics	Descriptive statistic
NRS assessed at baseline, *n* (%)	335 (90.0)
Baseline NRS, mean ± SD [range]	4.9 ± 2.8 [0–10]
Baseline NRS, mean ± SD [range]: No, analgesia	3.1 ± 2.5 [0–10]
Baseline NRS, mean ± SD [range]: Yes, analgesia	5.9 ± 2.5 [0–10]
Analgesia dose given, *n* (%)	232 (62.4)
Time to first analgesia dose in minutes, mean ± SD [range]	28.8 ± 24.1 [0–176]
Type of analgesia *n* = 232; *n* (%)	
Fentanyl	181 (78.5)
Morphine	26 (10.7)
Ketamine	21 (9.0)
Acetaminophen	2 (0.9)
Hydromorphone	2 (0.9)
Amount of analgesia	
Acetaminophen in mg, mean ± SD [range]	1000.0 ± 0.0 [1000–1000]
Fentanyl in mcg, mean ± SD [range]	44.3 ± 10.6 [25–60]
Ketamine in mg, mean ± SD [range]	26.2 ± 15.8 [10–70]
Morphine in mg, mean ± SD [range]	3.7 ± 1.9 [1–10]
Hydromorphone in mg, mean ± SD [range]	1.0 ± 0.0 [1–1]
Route of analgesia n = 232; *n* (%)	
IV	229 (98.7)
Oral	2 (0.9)
IO	1 (0.4%)
NRS re-assessed after first dose, *n* (%): n = 232	188 (81.0%)
NRS difference after first dose n = 188; mean ± SD [range]	1.1 ± 1.6 [-2 to 7]
NRS difference by type of analgesia	
Fentanyl n = 148; mean ± SD [range]	1.1 ± 1.6 [-2 to 7]
Morphine n = 23; mean ± SD [range]	1.4 ± 1.4 [0–4]
Ketamine n = 14; mean ± SD [range]	1.1 ± 1.5 [0–4]
Acetaminophen n = 1; mean ± SD [range]	0.0 ± 0.0 [0–0]
Hydromorphone n = 2; mean ± SD [range]	1.0 ± 1.4 [0–2]
NRS difference after first dose equal to zero n = 188; *n* (%)	44 (23.4)
Number requiring additional doses n = 232; *n* (%)	171 (73.7)
Mean number of additional doses, mean ± SD [range]	2.4 ± 2.0 [1–18]

IO = intraosseous; IV = intravenous; mcg = micrograms; mg = milligrams; NRS = numerical rating scale for pain assessment; SD = standard deviation.

DISCUSSION

Interpretation of findings

In this health record review, we evaluated the pain management practices of flight paramedics during transport of trauma patients by air. We found that the majority of patients were assessed for pain at baseline and, then, again after the first dose of analgesia. Pain at baseline was moderate on average. Although the first dose of analgesia had minimal effect on pain, it needs to be

Table 4. Pain and analgesia data for the second, third, and fourth to nineteenth doses

Characteristics	Second dose (n = 171) Descriptive statistic	Third dose (n = 102) Descriptive statistic	Fourth to nineteenth dose (n = 133) Descriptive statistic
Time to analgesia in minutes, mean ± SD [range]	48.0 ± 29.8 [8–153]	60.8 ± 33.3 [17–182]	92.6 ± 49.4 [18–260]
Type of analgesia, n (%)			
Fentanyl	132 (77.6)	79 (77.4)	90 (67.7)
Ketamine	25 (14.7)	17 (16.6)	37 (27.8)
Morphine	12 (6.5)	6 (6)	6 (4.5)
Ketorolac	2 (1.2)	-	-
Amount of analgesia			
Fentanyl in mcg, mean ± SD [range]	44.6 ± 10.3 [0–50]	44.8 ± 20.9 [25–200]	43.6 ± 11.0 [25–50]
Ketamine in mg, mean ± SD [range]	20.2 ± 11.0 [10–50]	18.8 ± 11.3 [10–50]	24.2 ± 14.9 [10–60]
Morphine in mg, mean ± SD [range]	2.8 ± 1.2 [1–5]	2.9 ± 0.9 [2–4]	2.2 ± 0.3 [2–2.5]
Ketorolac in mg, mean ± SD [range]	30.0 ± 0.0 [30–30]	-	-
Route of analgesia			
IV	169/171 (99)	100/102 (99)	32/133 (99)
IM	1/171 (1)	-	-
IO	-	1/102 (1)	1/133 (1)
NRS assessed, n (%)	136 (80)	78 (77)	108 (81)
NRS difference, mean ± SD [range]	0.6 ± 1.2 [-3 to 5]	0.5 ± 1.3 [-3 to 5]	0.5 ± 1.1 [-1 to 5]
NRS difference equal to zero (0), n (%)	89 (65.4)	51 (65.4)	77 (71.3)

IO = intraosseous; IM = intramuscular; IV = intravenous; mcg: micrograms; mg: milligrams; NRS = numerical rating scale for pain assessment; SD = standard deviation.

recognized that the average dose of fentanyl given was far less than the generally recommended 1–2 mcg/kg. Subsequent doses of analgesia appeared to have even less of an impact. Furthermore, with almost one-quarter of patients

Table 5. Adverse events following analgesia

Characteristics	Descriptive statistic
Total number of patients who had an AE following a dose of analgesia, n (%)	32 (13.8)
Total number of AEs following total number of doses of analgesia, n = 638; n (%)	43 (6.7)
Total number of AEs by type n = 43; n (%)	
Nausea	17 (39.5)
Oxygen saturation < 90	10 (23.3)
Systolic BP < 90	9 (20.9)
RR < 10	3 (7.0)
Systolic BP < 90 + oxygen saturation < 90	2 (4.7)
Vomiting	1 (2.3)
Systolic BP < 90 + nausea	1 (2.3)
Total number of AEs by dose of analgesia n = 43; n (%)	
First dose	21 (48.8)
Second dose	8 (18.6)
Third dose	6 (14.0)
Fourth to nineteenth doses	8 (18.6)

AE = adverse event; BP = blood pressure; RR = respiratory rate.

experiencing no pain relief after the first dose of analgesia, it reinforces that the dosing was inadequate. The prolonged time interval (up to 153 minutes) between the first and second dose of analgesia explains why some patients perceived worse pain after the first dose, in that they initially obtained some relief but were, then, allowed to re-experience pain as the initial dose wore off, and the analgesia was not titrated accordingly.

Postulating, more specifically, as to why this patient population received oligoanalgesia is challenging given the constraints of our study (e.g., retrospective review and qualitative analysis). Potential factors involved could be paramedic hesitation with medication side effects in treating unstable, critically ill patients; requirements of online medical direction for opioid administration and other analgesia; and a lack of weight-based dosing. Regardless, based on our results, it is our contention that there is an opportunity to improve the management of acute pain in this patient population.

Comparison to previous studies

Management of pain is a topic of continued interest because of the need for the provision of effective analgesia in prehospital settings.[19] In a study of 1,156 patients with isolated limb injury rescued by air in Switzerland,

Eidenbenz et al. found a similar percentage of patients received analgesia as in our study, although their cohort's baseline pain scores were higher.[20] They also found fentanyl was their most commonly administered analgesic. In contrast, of 381 patients evacuated by US critical care air transport teams, fentanyl was only the third most popular analgesic behind morphine and hydromorphone.[21] In our study, morphine and ketamine were distant second and third choices behind fentanyl, and hydromorphone was used in less than 1% of patients.

Dijkstra et al. conducted a systematic review of pain management in trauma patients and showed that paracetamol and intravenous (IV) opioids (morphine and fentanyl) were effective, but non-steroidal anti-inflammatory drugs (NSAIDS) had mixed results.[22] They stressed that future studies should examine analgesic effectiveness and drug safety in prehospital emergency care. Our study addresses their suggestion, wherein we highlight that air medical crew members commonly administer morphine and fentanyl with minimal resultant drug-related adverse events. Smith et al. had similar results in 103 US trauma patients, showing no significant difference in analgesic effectiveness or incidence of adverse effects between morphine and fentanyl.[23] However, a study involving intensive care helicopter paramedics in Australia established that a clinically significant pain reduction of ≥2 points was achieved by 87.0% of adult trauma patients while using ketamine in 18.5% of cases.[24] In contrast, our study showed that 23.4% of patients had no difference in numerical rating scale after the first analgesia dose. What these results seem to show is that a lack of evidence-based protocols or guidelines[22] can result in varying degrees of success in terms of pain management.

Strengths and limitations

Our study has several strengths compared with the existing literature in this field. We abstracted a greater number of variables that allowed us to ascertain trends regarding effectiveness. More importantly, we examined real-time concurrent assessments of pain and pain management during en route care in a generalizable population of trauma patients, as opposed to the only other previous study in 12 flights of 114 less severely ill and injured US military patients.[25] We also followed a thorough health record review process that included a double-check on 10% of cases showing 100% correctness of data abstraction from the electronic paramedic records.

Our study was a health record review, making it impossible to control exposure or outcome assessment. We did not attempt to calculate any associations between not receiving a second dose and adverse events, comorbidities or vital signs, or type or site of injury. We were reliant on the accuracy of record-keeping in the Ornge electronic paramedic records. It was not possible to delineate whether the fact that 50.3% of patients received pre-transport analgesia impacted the analgesia delivered en route by the flight paramedics. We were also unable to procure accurate details on the pre-transport analgesic administration (e.g., type of medication and dosing). We may have encountered selection bias, given patients were excluded with a GCS score <14; however, this was deemed necessary from a patient perspective to obtain accurate and reliable numerical rating scale pain assessments. We were not able to rule out under-reporting of adverse events to account for the low number of adverse events observed following the total number of analgesia doses. Furthermore, it is unfeasible for us to be sure that the analgesia dose resulted in the adverse event; these are multisystem trauma patients, and it is difficult to resolve analgesic dose versus injury or blood loss as the reason for the adverse event. Finally, we were likely underpowered to contemplate formally testing statistical differences between various sub-groups and, therefore, were limited to descriptive statistics.

CONCLUSION

In the majority of patients, initial and subsequent dose(s) of analgesic dose had a minimal effect on pain as assessed using the numerical rating scale, due in part to inadequate dosing and a long time interval between doses. Future research is required to determine the reasons for oligoanalgesia and methods to improve the management of pain in this patient population.

Competing interests: None.

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