BJA

Undertreatment of acute pain (oligoanalgesia) and medical practice variation in prehospital analgesia of adult trauma patients: a 10 yr retrospective study

E. Albrecht[1], P. Taffe[2], B. Yersin[3], P. Schoettker[1], I. Decosterd[1] and O. Hugli[3]*

[1] Department of Anaesthesiology, [2] Institute of Social and Preventive Medicine, and [3] Emergency Department, Lausanne University Hospital, Bugnon 46, 1011 Lausanne, Switzerland

* Corresponding author. E-mail: olivier.hugli@chuv.ch

Editor's key points

- There is evidence of undertreatment of pain in trauma patients at the prehospital stage.
- This retrospective review of patient records did find some undertreatment of pain.
- A number of factors increase the likelihood of oligoanalgesia, including being treated by a female physician, having severe pain before starting treatment, and being treated by a relatively junior member of the team.
- Further research is needed to clarify causal links and understand further the factors underlying oligoanalgesia.

Background. Prehospital oligoanalgesia is prevalent among trauma victims, even when the emergency medical services team includes a physician. We investigated if not only patients' characteristics but physicians' practice variations contributed to prehospital oligoanalgesia.

Methods. Patient records of conscious adult trauma victims transported by our air rescue helicopter service over 10 yr were reviewed retrospectively. Oligoanalgesia was defined as a numeric rating scale (NRS) >3 at hospital admission. Multilevel logistic regression analysis was used to predict oligoanalgesia, accounting first for patient case-mix, and then physician-level clustering. The intraclass correlation was expressed as the median odds ratio (MOR).

Results. A total of 1202 patients and 77 physicians were included in the study. NRS at the scene was 6.9 (1.9). The prevalence of oligoanalgesia was 43%. Physicians had a median of 5.7 yr (inter-quartile range: 4.2–7.5) of post-graduate training and 27% were female. In our multilevel analysis, significant predictors of oligoanalgesia were: no analgesia [odds ratio (OR) 8.8], National Advisory Committee for Aeronautics V on site (OR 4.4), NRS on site (OR 1.5 per additional NRS unit >4), female physician (OR 2.0), and years of post-graduate experience [>4.0 to ≤5.0 (OR 1.3), >3.0 to ≤4.0 (OR 1.6), >2.0 to ≤3.0 (OR 2.6), and ≤2.0 yr (OR 16.7)]. The MOR was 2.6, and was statistically significant.

Conclusions. Physicians' practice variations contributed to oligoanalgesia, a factor often overlooked in analyses of prehospital pain management. Further exploration of the sources of these variations may provide innovative targets for quality improvement programmes to achieve consistent pain relief for trauma victims.

Keywords: clinical practice variation; emergency medical services; physician's practice patterns; prehospital emergency care; wounds and injuries

Accepted for publication: 18 July 2012

Acute pain is common in prehospital medicine and is experienced by 35–70% of trauma patients.[1] [2] Efficient analgesia reduces both physiological and psychological stress, and in the prehospital setting, it also facilitates extrication from wreckage and therapeutic manoeuvres.[2] However, the emergency medicine literature reports that acute pain is undertreated, a phenomenon defined as oligoanalgesia.[3] The available emergency medicine literature to date focuses on patients' characteristics (i.e. patient gender[4] or age)[5] as determinants of oligoanalgesia. Prehospital oligoanalgesia results from either a complete lack of analgesia (unrelieved pain)[4] [6–8] or an insufficient dose of analgesics (unachieved analgesia), both of which are the results of a medical decision.[9] Physicians have recently been logically included as additional determinants of this phenomenon. Significant variation in analgesic decision-making among emergency physicians has been documented using written vignettes,[10] [11] and also from studying physicians' actions in the emergency department (ED),[12] but never in the prehospital setting.

The primary goal of this 10 yr retrospective study was to assess how oligoanalgesia was associated with physicians' practice variation among non-intubated adult trauma patients transported by our physician-staffed air-medical transport system to our ED, taking into account both patients' and physicians' characteristics. A secondary goal was to assess if oligoanalgesia was related to undelivered analgesia, or delivered but unachieved analgesia.

Methods

Study design

This was a single centre, retrospective chart review of trauma patients transported from the accident site to our hospital by helicopter between January 1, 1997, and December 31, 2006. This retrospective study was approved by the Ethics Committee of our institution.

Setting

Our University Hospital is a level 1 trauma centre, and the physician-staffed air rescue helicopter is dispatched to the scene based on alarm keywords and location of the emergency.[13] The physician is either a member of the ED staff or is a resident. Residents rotate to the ED for 6 or 12 months from the internal medicine or anaesthesiology residency programmes of our institution, after having completed a minimum of 1 yr of residency in the anaesthesiology department. According to our pain management protocol, acute pain was assessed using the numeric rating scale (NRS) and documented both on site and upon hospital arrival. Pain was treated with i.v. fentanyl 0.5–2 $\mu g\ kg^{-1}$ in small incremental doses, targeting an NRS ≤ 3. There was no explicit limit to dose intervals or maximum cumulative dose, and all doses were based on the degree of pain relief needed. Injections of other medications such as benzodiazepines or ketamine were left to the physicians' discretion. After each transport mission, physicians filled out a standardized report recording a short description of the case, the patient's characteristic data, vital signs, physical examination, and initial prehospital diagnoses. An attending physician verified that all report items were completed. Thereafter, a data manager inputted all data into a Filemaker® database (Filemaker 5, Santa Clara, CA, USA).

Selection of participants

All consecutive non-intubated adult trauma patients were screened for inclusion in the study. Inclusion criteria were: age 16 yr or older, a Glasgow coma scale (GCS) ≥ 13 both on site and upon hospital arrival, and an NRS >3 at the scene. The 11-point NRS is anchored with 0 as no pain and 10 as maximal imaginable pain. Patients were excluded from the analysis if NRS was not recorded at the scene or upon arrival at hospital or if GCS decreased below 13 at hospital. Oligoanalgesia was defined as an NRS >3 upon arrival in our ED;[14] patients were included if oligoanalgesia was due to a lack of analgesics (unrelieved pain) or due to an insufficient dose of analgesics (unachieved analgesia). All patients were assessed by the prehospital physician according to the Munich modification of the National Advisory Committee for Aeronautics (NACA) score,[15] and by the injury severity score (ISS).[16] Physicians' characteristics were retrieved from our administrative database.

Statistical analysis

Subjects were dichotomized into groups according to oligoanalgesia on admission. Summary statistics were presented as proportions (%), means and standard deviations (SD), or when specified, as medians and inter-quartile range (IQR) for skewed data. Bivariate associations between the outcome variables and the independent variables were assessed using the χ^2 test for discrete predictors. The most appropriate transformation for continuous predictors was assessed using simple logistic regression along with fractional polynomial dose–response modelling.

Our data have a hierarchical structure with regard to analgesia; the individual interventions are nested within a cluster of physician interventions. Therefore, multilevel logistic regression analysis was used. The impact of physician unmeasured characteristics (contextual factors) was quantified using the median odds ratio (MOR), whereas the interval odds ratio (IOR) was used to assess the importance of physician measured characteristics. As neither the variance nor the distribution of the MOR is known, nested studentized Bootstrap (Bootstrap-*t*) confidence intervals were calculated. A detailed description of the statistical analyses used can be found in Appendix 1.

Estimations were made using maximum likelihood. Goodness-of-fit analyses were performed using the Hosmer–Lemeshow test, and the area under the receiver operating characteristic (ROC) curve. All analyses were performed using STATA 11.2 (Stata Corporation, College Station, TX, USA).

Results

Study population

A total of 4904 transport missions were reviewed, and 1202 patients met the inclusion criteria (Fig. 1). The mean age was 39 (17) yr and the majority was male (Table 1). On average, vital signs were within normal limits on site (data not shown), but tachypnoea was present in 16%, and hypoxaemia in 2.1% of victims. The most frequently injured body areas were the limbs, and 50% of patients had multiple injuries. The majority of patients had an NACA score >II. The mean ISS was 9.8 (8.4), and nearly one-quarter of all patients had an ISS >15.

Overall, 14 patients (1.2%) had a GCS <13 on arrival (Fig. 1); of whom, 10 (71%) were oversedated; all of them had received a combination of at least two central nervous system depressants (Appendix 2).

Pain at the scene was moderate to severe, and was significantly higher in men. Fentanyl was administered to the majority of patients. Ketamine was the only analgesic used in 2.1% of patients. Pain alleviation between the accident site and hospital was 3.5 (2.3) units ($P<0.001$); both genders experienced the same pain reduction of 3.4 units ($P=0.94$). The absolute NRS reduction was greater when initial NRS was higher (Table 2).