vasopressors). The control group received placebo plus standard of care. The primary composite endpoint was control of shock within 6 hours of the diagnosis of sepsis with hypotension. Shock control was defined by a MAP >65mmHg plus either urine output > 0.5mL/kg/h or a decrease of baseline lactate by 10%. Secondary outcomes included 28-day mortality and hospital mortality. Multiple safety outcomes were also recorded.

Three hundred ten patients were randomized. The groups were well matched with regard to prognostic factors. The median door-to-norepinephrine time was 99 minutes less in the treatment group (93 vs 192 minutes, P<0.001), with a 27.7 % increase in shock control at 6 hours (OR=3.4; 95% confidence interval [CI]: 2.09–5.53). There were no differences in rates of ICU admissions, hospital length of stay, 28-day mortality rates or hospital mortality rates.

Of the safety outcomes, cardiogenic pulmonary edema and new onset arrhythmias had a lower incidence in the early NE group compared to control. Episodes of cardiogenic pulmonary edema were 14.4% in the NE group compared to 27.7% in the control group (p=0.04). Interestingly, there was no difference in fluid resuscitation within the first 3 days. Total volume status during hospital stay was not calculated which may have elucidated the etiology of the cardiogenic pulmonary edema. Given that early NE when compared to control achieved both MABP and target urine output earlier (35.5% vs 24.% (p=0.04)), the authors inferred that the patient's ability to diurese unnecessary volume early in their course could have played a part in the lower rates of pulmonary edema found in the NE group. Their second safety endpoint, new onset arrhythmias, also occurred less often in the treatment group (11% vs 20%; p=.03). As NE has been shown to increase global perfusion without significant improvement in coronary perfusion, the authors postulated that the reduction in arrhythmias was due to a shorter duration of myocardial oxygen demand secondary to early shock control. Currently, no safety data exists regarding NE and its association with arrhythmias in the setting of sepsis.

The authors found a statistically significant association between early norepinephrine and increased shock control within 6 hours and suggest this protocol may be superior to current standards of care.

[Alex Rahnema, MD
Jerrilyn Jones, MD, MPH
University of Arkansas for Medical Sciences, Little Rock, Arkansas]

*Comment:* This RCT is the first to date that has analysed prospective early administration of norepinephrine in management of sepsis with hypotension. While there was robust randomization, the rapid effect that early NE had blood pressure could have potentially unblinded physicians. Also, while patients often do suffer from iatrogenic fluid overload in the management of sepsis, future studies should consider total volume status from admission to discharge in order to understand the relationship between early NE use and observed lower rates of cardiogenic pulmonary edema. Unfortunately this study found no differences between mortality or length of stay so we can't say if NE truly provides a clinically significant benefit, however we suspect the study may have been underpowered for those outcomes.

## ☐ KETAMINE INFUSION FOR PAIN CONTROL IN ADULT PATIENTS WITH MULTIPLE RIB FRACTURES: RESULTS OF A RANDOMIZED CONTROL TRIAL.

Carver TW, Kugler NW, Juul J, et al. *J Trauma Acute Care Surg*. 2019;86(2):181-188

For trauma patients with rib fractures, adequate pain control is critical to decreasing mortality from respiratory complications. Historically rib fracture pain management has predominantly depended on narcotics; however growing concerns about the side effects as well as dependency issues associated with opioids has sparked interest in alternative therapies. Although ketamine is usually used as adjunct therapy for patients with pain refractory to traditional multimodal pain protocols, there is data to suggest that use of low-dose ketamine (LDK) may decrease a patient's opioid requirement.

The goal of this study was to evaluate the use of LDK for primary pain management of traumatic rib fractures as opposed to adjunct therapy. Adult blunt trauma patients with three or more rib fractures were randomized to receive LDK infusion ($2.5\mu g \cdot kg^{-1} \cdot min^{-1}$) or similar volume of placebo (0.9% sodium chloride) for 48 hours. Patients were excluded from the trial for various reasons, including age over 65 years, Glasgow Coma Scale (GCS) less than 14, a history of psychosis, use of more than 2 psychotropic medications, chronic opioid use, currently had substance abuse issues, active acute coronary syndrome, and severe hypertension. The primary outcome of this prospective, randomized, double-blinded, placebo-controlled trial was a reduction in numeric pain scores (NPS) 24 hours after initiation of LDK infusion compared to NPS of patients receiving placebo. The authors defined a clinically significant reduction in NPS as a two-point reduction on the 11-point scale. Secondary outcomes included reduction in NPS at 48 hours, oral morphine equivalents (OME) required at 24 and 48 hours, total for hospitalization, hospital length of stay, time spent in the intensive are unit (ICU), epidural placement rate, and incidence of pulmonary complications and adverse events.

Ninety-one patients who presented to Froedtert Memorial Lutheran Medical Center, a Level I Trauma Center, from August 2015 to December 2017 after blunt trauma were randomized into the trial. Forty-five patients received LDK infusion and 46 were randomized to receive placebo. Motor vehicle collision (MVC) accounted for 45.7% of injuries and patients were predominantly male (74.7%) with a median age of 49 years and median Injury Severity Score (ISS) of 14. Seventy-five patients received more than 36 hours of infusion with no difference in infusion duration between the experimental (LDK) arm and placebo. Patients received standard multimodal pain management with oral nonsteroidal anti-inflammatory medications, acetaminophen, and muscle relaxants, however the groups had similar utilization of these medications. There was no difference in NPS or OME totals between the two groups. Rate of adverse events or epidural placement was not significantly different between the two groups. Subset analysis did show, however, a significant reduction in OME for severely injured patients (ISS > 15) receiving LDK (OME 180.3 for LDK group versus 328.5 in placebo, p<0.05).

The authors concluded that although LDK did not significantly decrease NPS or OME for all trauma patients, there was a reduction in OME for severely injured patients (ISS > 15). The investigators suggest that LDK may lead to a reduction in opioid use in severely injured patients; however further research is still required. There were many limitations to this study including the subjectivity of NPS and lack of standardization of amounts and route of other pain medications received.

[Laura Elizabeth Werline, MD
Amanda Young, MD
University of Arkansas for Medical Sciences, Little Rock, AR]

*Comment:* This study suggests an interesting new role for ketamine in treatment of acute pain caused by traumatic injuries. Although LDK infusion was not proven to reduce NPS or OME compared to placebo, there was a significant reduction in OME used in severely injured patients (ISS > 15). Additional randomized control trials are required to further determine protocols for LDK use in acute trauma patients, especially regarding dosing and titration of the infusion. Investigation into the risks and benefits of initiation of LDK infusion in the emergency department setting cannot be sufficiently studied until adequate protocols are established. This study primarily focuses on outcomes more than 24 hours after initiation of LDK, when patients are no longer in the emergency department. Specific research regarding the possible benefits in the initial 12 hours after starting LDK infusion is needed for this to apply to management of acute traumatic pain in the emergency department setting.

### ☐ IMPACT OF SCRIBES ON EMERGENCY MEDICINE DOCTORS' PRODUCTIVITY AND PATIENT THROUGHOUT: MULTICENTRE RANDOMIZED TRIAL.

Walker K, Ben-Meir M, Dunlop W, et al. *BMJ*. 2019;364:l121

The use of medical scribes is becoming increasingly popular in emergency departments. Medical scribes are believed to allow physicians to increase the number of patients seen per shift by offloading various clerical tasks. There is limited data on the effect of medical scribes on physician productivity and no multicenter randomized studies had been conducted prior to this trial.

This was a prospective, multicenter, randomized clinical trial that compared physician productivity with and without scribes amongst 88 physicians (ages 32 – 65 years) at five emergency departments in Victoria, Australia. Authors felt these sites were representative of typical Australian emergency departments. Scribes underwent standardized training with testing of competency. Twelve scribes were assigned to physician shifts using a computerized random number generator. Physician productivity was the primary outcome measured using patient throughput with and without scribes. Of note, the Australian emergency departments in this study have a system in which patients may see a single physician or multiple physicians. A primary consultation refers to a main physician providing triage, management and discharge of a patient while a secondary consultation refers to cases in which the patient is seen by a separate physician for full consultation or a patient handover occurs. The primary outcome looked at productivity measures as patients per hour per doctor. Secondary outcomes included door-to-doctor time, median length of stay, and effects of scribes in various regions of the emergency department. Authors also examined incidents reported with scribes present and performed a cost-benefit analysis.

A total of 28,936 patients were seen over the course of the study with 5,098 patients seen during scribed shifts. Comparison of non-scribed versus scribed shifts showed productivity improved from 1.13 (95% CI 1.11-1.17) to 1.31 (95% CI 1.25-1.38) total patients per hour per doctor, respectively ($p < 0.001$). Productivity for primary consultations also improved from 0.83 (95% CI 0.81-0.85) without scribes to 1.04 (95% CI 0.98-1.11) primary patients per hour per doctor with scribes ($p < 0.001$). Length of stay improved, with a median length of stay of 192 minutes (interquartile range 108-311) during non-scribed shifts to 173 minutes (interquartile range 96-208) during scribed shifts ($p < 0.001$). Door-to-doctor time saw no statistically significant difference. The greatest increase in throughput was seen in triage, followed by acute and pediatric areas while sub-acute, fast track and observation areas saw no significant benefit. A cost benefit analysis showed the use of scribes to be financially beneficial with a cost savings of $26.15 per scribed hour. If training costs were covered by the scribe, savings increased to $31.15 per scribed hour. There were 16 total errors when scribes were used (1 in every 300 consultations). Errors most commonly revolved around patient identification (i.e., selecting the incorrect patient in the electronic medical record) and were recognized by the physician or scribe in all cases so no patient harm occurred.

The authors concluded that the use of scribes improved physician productivity, decreased length of stay and demonstrated significant cost savings. They recognized that actual productivity may be overestimated since physicians were aware of the study's intent. Additionally, there was no data regarding physician time spent documenting after the shift which could significantly alter the data. They also reported that although few errors occurred with scribe use, the true harm is likely underestimated since errors were identified through self-reporting.

[Ryan Matthews, MD
Amanda Young, MD
University of Arkansas for Medical Sciences, Little Rock, Arkansas]

*Comment:* It makes intuitive sense that offloading clerical duties to a well-trained scribe would allow physicians to dedicate more time to patient care. This multicenter study of physician productivity with scribes shows multiple statistically significant benefits to using scribes in the emergency department. The generalizability may be limited as the study took place at five sites in Australia. Bias may exist as well due to the Hawthorn effect. Further research is needed for other geographical locations due to differences in healthcare infrastructure that could influence both productivity and cost benefit analysis. Additionally, more research into patient safety would be beneficial.