MULTI-MODALITY PAIN CONTROL FOR RIB FRACTURES

SUMMARY

Acute traumatic rib fracture related pain can be difficult to control. Narcotic medications have traditionally been the mainstay of therapy, but are increasingly falling out of favor, due to their well-known side effect profile including respiratory depression, delirium, hypotension, constipation, and addiction. Multi-modality pain therapy that includes both non-steroidal anti-inflammatory agents (NSAIDS) and as needed opiates has been demonstrated to result in improved pain control with less opiate use and decreased morbidity.

RECOMMENDATIONS

- **Level 1**
  - **None**
- **Level 2**
  - **Multimodal treatment regimens should be used in patients with multiple rib fractures including scheduled non-steroidal anti-inflammatory agents (NSAIDs), acetaminophen, muscle relaxants, and as needed low-dose narcotics.**
  - **Initiate narcotic therapy with the lowest opiate dosage that achieves pain control with careful use in the elderly.**
- **Level 3**
  - **Scheduled analgesic agents are the most appropriate approach to medication dosing.**
  - **In patients with multiple rib fractures, intravenous NSAIDs can be instituted to help achieve acute pain control.**
    - **Ibuprofen 400-800 mg IV q 6 hours OR ketorolac tromethamine 15-30 mg IV q 6 hours**
    - **IV NSAID therapy should be limited to a maximum of five (5) days**
  - **IV narcotics or patient-controlled analgesia (PCA) opiates can be utilized to control pain that is not adequately managed with oral medications alone.**
  - **Epidural analgesia and intercostal nerve blockade may be a useful adjunct to multi-modality pain medication regimens.**

INTRODUCTION

Rib fractures are common among the traumatically injured and are increasing in incidence. An estimated 350,000 patients in the U.S. alone were diagnosed with rib fractures in the year 2017 (1). While the pain associated with a single rib fracture is relatively easy to control, the significant pain of multiple rib fractures can be difficult to manage and can lead to decreased pulmonary function, increased hospital length of stay, and increased health care expenditures. The probability of pneumonia and death is directly correlated to the number of fractured ribs as well as the age of the patient. Multi-modality therapy for multiple rib fracture-related pain control remains the standard treatment modality with early administration of NSAIDs, acetaminophen, muscle relaxants and low-dose opiates.

EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

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LITERATURE REVIEW

Injury severity and patient age following traumatic injury are two of the strongest predictors of patient survival. Younger patients tend to fare better with injuries that cause significant morbidity and mortality among older patients. Multiple rib fractures are associated with a significantly increased morbidity and mortality compared to single rib fractures. Bulger et al. showed a difference in mortality of 10% vs. 22% in young (18-64 years) vs. old (≥ 65 years) patients with rib fractures (2). There were also differences in ventilator days (3.1 vs. 4.3 days), intensive care unit days (4.0 vs. 6.1 days), and hospital length of stay (10.7 vs. 15.4 days) among young vs. old patients. Recent studies have also shown a significantly increased mortality among elderly patients admitted to a trauma center with rib fractures, and that the disability associated with rib fractures can be longer lasting than previously recognized (3,4).

Intermittent, scheduled analgesia [as compared to patient controlled analgesia (PCA) dosing or epidural analgesia] has been shown to be equally effective in pain control for elderly patients with blunt thoracic trauma (5). PCA dosing (while useful in acute post-operative pain) is becoming less common in the treatment of rib fractures and is typically reserved for hard to control pain or patients with chronic opiate usage.

Yang et al. demonstrated a decreased risk of pulmonary complications in a retrospective review of patients receiving IV ketorolac within 4 days of sustaining rib fractures compared to a control group. They also found a decrease in ICU days as well as an increase in ventilator free days without the apparent risks commonly attributed to NSAID use (e.g., gastrointestinal bleed, kidney injury, impaired fracture healing) (6).

Ibuprofen (IV or oral) is a non-narcotic adjunct for the treatment of post-surgical and post-trauma pain. Southworth et al. studied the use of IV ibuprofen in a multicenter randomized trial of elective orthopedic and abdominal surgery patients (7). Patients were given IV morphine by PCA and randomized to receive either 400 or 800 mg of IV ibuprofen or placebo. The first dose of study drug was administered intra-operatively at closure of the surgical wound. It was then given every six (6) hours for the first 48 hours of admission. The drug was then continued at the discretion of the investigator within a maximum duration of five (5) days. Median morphine use was significantly less in the 800 mg ibuprofen group (p=0.03). Median pain scores were also significantly less in the 800 mg and 400 mg ibuprofen groups compared to placebo.

Similarly, in a study performed at Orlando Regional Medical Center, Bayouth et al. retrospectively compared a cohort of patients with traumatic rib fractures who received IV ibuprofen and narcotics to an age and rib fracture matched control group receiving narcotics only. They demonstrated that early IV ibuprofen therapy in patients with traumatic rib fractures significantly decreases narcotic requirement and results in clinically significant decreases in hospital length of stay (8).

Contraindications to ibuprofen usage include, but are not limited to (9):

- Known hypersensitivity to ibuprofen or other NSAIDs
- Asthma, urticaria, or allergic-type reactions after taking aspirin or NSAIDs
- Peri-operative use in the setting of coronary artery bypass graft (CABG)

Precautions for ibuprofen usage include:

- Serious and potentially fatal cardiovascular thrombotic events
- Serious gastrointestinal reactions
- Hepatic effects
- Hypertension
- Congestive heart failure and edema
- Renal impairment
- Serious skin reactions (Stevens-Johnson Syndrome, Toxic Epidermal Necrolysis)

Muscle relaxants, such as methocarbamol, have been demonstrated to improve pain control in patients with multiple rib fractures. A complete discussion on this class of medications can be found in the evidence-based medicine guideline, "**Muscle Relaxants in Multimodal Pain Management"**, available at www.surgicalctiticalcare.net. Gabapentin (Neurontin) can also be utilized in the multimodal treatment of rib fractures, but there is no consensus on its proven benefit. A recent randomized control trial of gabapentin

vs. placebo in critically ill patients with rib fractures showed no benefit to gabapentin use with similar hospital and ICU length of stay, incentive spirometer recordings and pulmonary complications (10). This is addressed in further detail in the evidence-based medicine guideline **"Gabapentin for Acute Postoperative Pain"**.

The evidence supporting a benefit to epidural analgesia for pain control following traumatic rib fracture is conflicting (11,12). Given the cost and procedural risks associated with this therapy, further research is necessary before definitive recommendations on epidural analgesia can be made. Rib plating is a therapeutic modality (discussed separately) that has proven to be beneficial in select patient populations with multiple rib fractures. This practice is becoming more widely utilized for rib fractures with randomized studies showing treatment benefits. Further discussion can be found in the evidence based medicine guideline, "**Surgical Fixation of Rib Fractures"** available at www.surgicalcriticalcare.net.

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Surgical Critical Care Evidence-Based Medicine Guidelines Committee

Primary Author: Kevin Wissinger, MD; Paul Wisniewski, DO, Kathleen Cannon, MD, Michelle Ganyo, MD, Michael VanGent, DO
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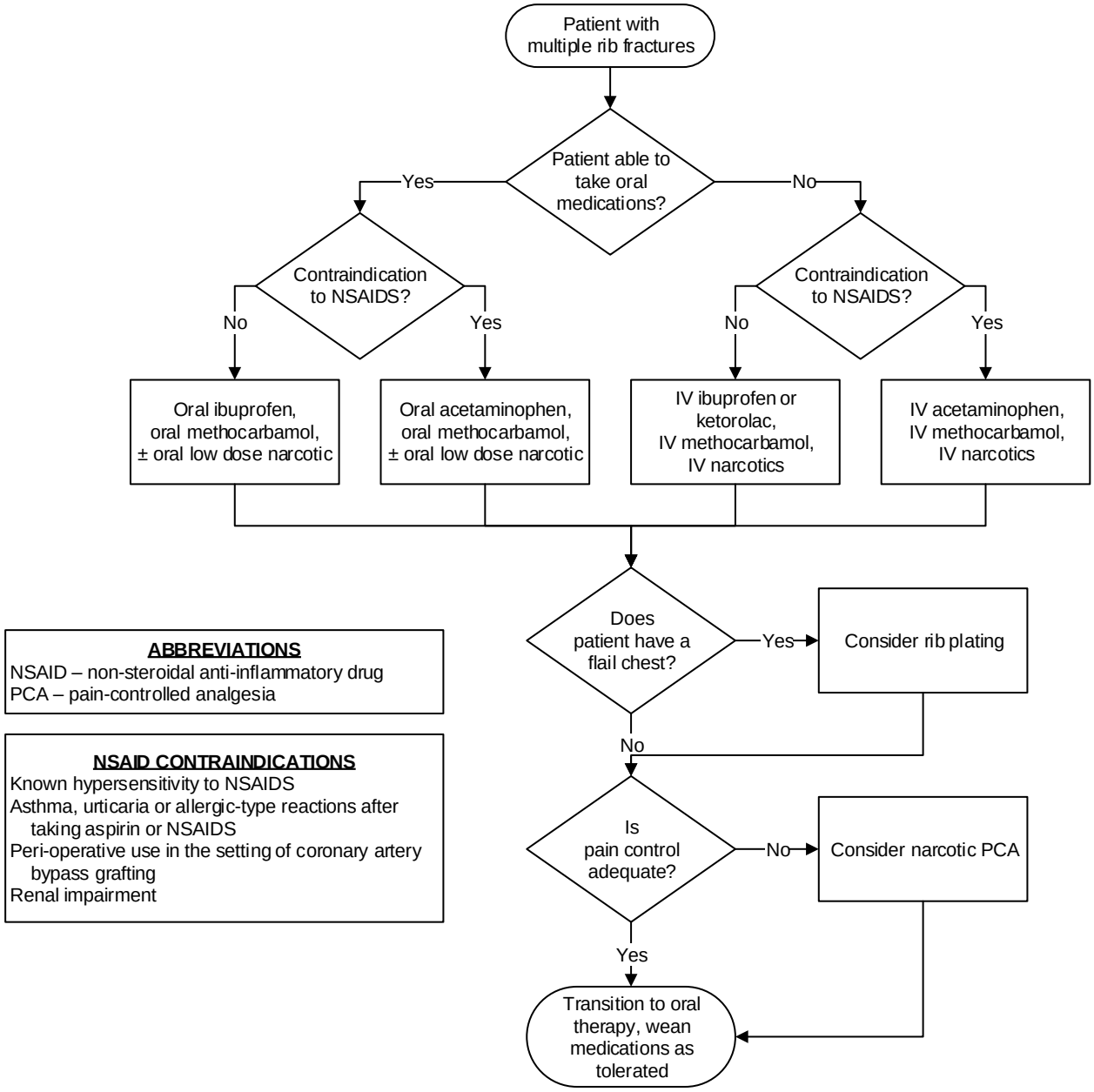
Please direct any questions or concerns to: webmaster@surgicalcriticalcare.net

Multi-modality Pain Control for Rib Fractures



ABBREVIATIONS
NSAID – non-steroidal anti-inflammatory drug
PCA – pain-controlled analgesia

NSAID CONTRAINDICATIONS
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Peri-operative use in the setting of coronary artery bypass grafting
Renal impairment

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