



# A Novel Multimodal Analgesia Pathway is Associated with Decreased Peri-procedural Opioid Consumption for Patients Undergoing CT-Guided Microwave Ablation in the Interventional Radiology Suite



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## INTRODUCTION

- Percutaneous CT-guided microwave ablation (MWA) has become a common treatment of both primary and metastatic hepatic malignancies. A significant portion of patients experience post-procedural visceral pain
- There is a growing need to manage acute, peri-procedural pain for patients undergoing procedures outside the operating room
- Enhanced recovery pathways incorporating multimodal analgesia are beneficial for surgical patients, but are not yet standard in the procedural space

**Purpose:** Study the impact of institutionalizing an enhanced recovery after procedure (ERAP) multimodal analgesic pathway on peri-procedural opioid administration for outpatients undergoing CT-guided percutaneous hepatic microwave ablation (MWA)

## METHODS

- IRB approved retrospective case series
- Inclusion: All patients undergoing CT-guided MWA for primary or metastatic hepatic malignancies at Massachusetts General Hospital from May 2016 to April 2022
- Inclusion criteria >18 years. Exclusion criteria were patients with procedural complications
- Patients were categorized into 3 groups:
  - Control
  - Preprocedural analgesic (PA)
  - PA with bilateral paravertebral block (PA+BPVB)
- Patients that received at least 1 of 4 ERAP preprocedural analgesics were grouped into the preprocedural analgesic (PA) cohort
- All PVBs were performed in the CT procedure room by the regional team
  - 20 mL of ropivacaine 0.5% or bupivacaine 0.5% with 1:400,000 epinephrine was injected per side.
  - A CT scan image was performed immediately after the block per liver MWA protocol as a tool to evaluate for complications of the PVBs including pneumothorax.
- Intra-procedure doses of hydromorphone were converted and documented as morphine equivalents (ME) for all groups
- Post-procedure opioids given in the recovery unit were converted into ME, which was documented until discharge to home
- If the patient was admitted, 24-hour ME was recorded from when the patient arrived to the post-procedure area. Hospital admission was recorded for all groups irrespective of the indication

## RESULTS

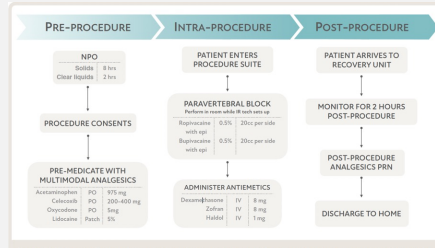


Fig 1. NORA ERAP protocol. The protocol was developed on the basis of prior studies showing the analgesic benefit of paravertebral blocks for ablative procedures and pre-operative multimodal non-opioid adjuncts to decrease post-operative opioid usage (Abu Elzayed & Abdullah, 2016; Culp et al., 2008; Pooson et al., 2014). NORA, non-operating room anesthesia; ERAP, enhanced recovery after procedure; NPO, nil per os; PO, per os; IV, intravenous; PRN, pro re nata

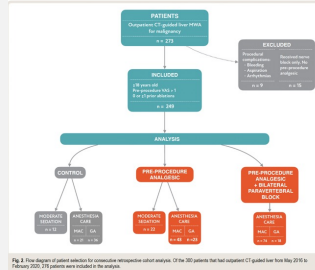


Fig 2. Flow diagram of patient selection for retrospective, interventional cohort analysis. Of the 307 patients that had undergone CT-guided liver MWA from May 2016 to February 2022, 273 patients were included in the analysis.

	Control	Pre-procedure Analgesic (PA)	Pre-procedure + Bilateral Paravertebral Block (PA+BPVB)	p-value**
Sample size (n)	89	83	82	
Mean intra-procedure ME (mg) (SD) [95% CI lower limit-upper limit]	13.81 (6.36) [10.12 - 17.50]	7.01 (4.22) [4.42 - 9.60]	2.82 (7.42) [1.10 - 4.56]	<0.0001
Mean post-procedure ME (mg) (SD) [95% CI lower limit-upper limit]	17.17 (41.86) [7.18 - 27.17]	7.99 (42.22) [0.98 - 14.93]	3.82 (8.13) [2.14 - 5.50]	0.008
VAS at 30 min (median [IQR])	0.0 [0.0, 0.3]	0.0 [0.0, 0.0]	0.0 [0.0, 2.0]	0.33
VAS at 60 min (median [IQR])	0.0 [0.0, 0.0]	0.0 [0.0, 0.0]	0.0 [0.0, 4.3]	0.767
VAS at 120 min (median [IQR])	2.0 [0.0, 4.0]	0.0 [0.0, 0.0]	0.0 [0.0, 4.8]	0.42
Mean procedure length (min) (SD) [95% CI lower limit-upper limit]	0.0 [0.0, 0.0]	0.0 [0.0, 0.0]	0.0 [0.0, 0.0]	0.003
Hospital admission count (n)	141 (3 (45.30) [132.4 - 152.2])	143 (1 (07.16) [131.0 - 155.3])	160 (2 (47.61) [150.1 - 169.8])	0.01
Hospital admission for pain count (% of total)	3 (4.3)	3 (4.4)	6 (6.4)	0.82

Abbreviations: ME, Morphine Equivalents; SD, Standard Deviation; CI, Confidence Interval; IQR, Interquartile Range; VAS, Visual Analog Scale  
\* p-value compares means of each group with every other group  
† Parametric and non-parametric ANOVA with multiple comparisons and adjustments to compare means where appropriate. Chi-squared used to compare proportions

	Control	Pre-procedure Analgesic (PA)	Pre-procedure + Bilateral Paravertebral Block (PA+BPVB)	p-value**
Sample size (n)	89	83	82	
Gender characteristics				
Male count (%)	47 (49.46)	62 (74.71)	60 (73.16)	0.009
Female count (%)	42 (47.06)	21 (25.29)	22 (26.84)	
Age characteristics (SD)	52.6 (10.3)	52.6 (10.3)	52.6 (10.3)	0.998
ASA class (n)	50 (56.2)	50 (60.2)	50 (60.2)	0.4
ASA class (n)	39 (43.8)	33 (39.8)	32 (39.1)	
Diagnosis characteristics (n)				
Hepatocellular carcinoma	47 (52.8)	46 (55.6)	45 (54.9)	0.722
Metastatic disease	42 (47.2)	37 (44.4)	37 (45.1)	
Metastatic disease (n)	30	30	30	0.94
Hypertension	19	20	20	0.34
Mean systolic blood pressure (SD) [95% CI lower limit-upper limit]	116.6 (22.2) [84.1 - 149.1]	116.6 (22.2) [84.1 - 149.1]	116.6 (22.2) [84.1 - 149.1]	0.887
Diabetes mellitus (n)	10	10	10	0.99
Chronic kidney disease (n)	0	0	0	0.98
Chronic liver disease (n)	0	0	0	0.98
Tamoxifen use (n)	0	0	0	0.98
Topical steroid use (n)	0	0	0	0.98
Concomitant medications (n)				
Aspirin	14 (15.6)	14 (16.9)	14 (17.1)	<0.001
PT inhibitor	1 (1.1)	1 (1.2)	1 (1.2)	
Anti-thrombotic	15 (16.7)	15 (18.1)	15 (18.3)	<0.001
Proton pump inhibitor	100	100	100	<0.001
Statins	100	100	100	<0.001
Oral hypoglycemics	0	0	0	0.98
Chemotherapy	0	0	0	0.98

Abbreviations: CI, Confidence Interval; SD, Standard Deviation; CI, Confidence Interval; ASA, American Society of Anesthesiologists; HCC, Hepatocellular Carcinoma  
\* p-value compares means of each group with every other group  
† Parametric and non-parametric ANOVA with multiple comparisons and adjustments to compare means where appropriate. Chi-squared used to compare proportions  
‡ p<0.05 significant

## RESULTS - Peri-procedural Opioid Dosage

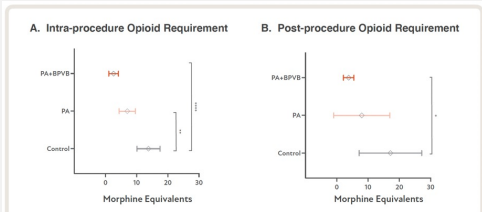


Fig 3. Opioid requirements. (A) Intra-procedure opioid requirements are significantly lower after PA+BPVB & PA+BPVB compared to control. (B) Decreased opioid requirements are sustained in the post-procedure period in the PA+BPVB group only compared to control. PA, pre-procedure analgesic; BPVB, bilateral paravertebral block, mg, milligrams

## DISCUSSION AND CONCLUSION

- Significant difference in post-procedure ME between the PA+BPVB (3.82 mg [95% CI 2.14 - 5.50]) and control group (17.17 mg [95% CI 7.16 - 27.17]; p=0.03).
- There was no association between hospital admission and pain scores on post-hoc analysis.

**Conclusion:** Applying a multimodal analgesic pathway with preprocedural analgesics and PVB is associated with decreased peri-procedural opioid administration for CT-guided hepatic MWA

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