Systemic Lidocaine for Pain Management in Renal Colic

Introduction

1. Over 2 million patients present the ED annually with suspected renal colic.[1]
2. Renal colic is an extremely painful condition characterized by sudden and severe flank pain. Due to the intense nature, timely, effective pain control is very important.[2]
3. Pain of renal colic is multifactorial and is related to the obstruction of urinary flow with a subsequent increase in intra-renal and intra-ureteral pressure and prostaglandin-mediated ureteral spasm.[2]
4. NSAIDs such as ketorolac and opioids constitute the primary treatment options for renal colic, alone or in combination.[2]
5. Ketorolac has several disadvantages including lack of titratability, side effects such as severe nausea and epigastric pain. Ketorolac is contraindicated in renal insufficiency, congestive HF, and acute peptic ulcer disease.[3]
6. Lidocaine is a local anesthetic that works by inhibiting depolarizing nerve cell membranes, preventing transmission of afferent pain signals, and altering sympathetic smooth muscle tone.[4]
7. Lidocaine also augments opioid-mediated analgesic effects and induces an opioid-sparing effect by interacting with the μ and κ opioid receptors.[5]
8. IV lidocaine has proven to be effective at managing of other types of pain such as acute post-surgical pain and chronic opioid-refractory pain with minimal side effects.[5]

Pharmacology[4]

	Lidocaine
Mechanism of Action	Blocks the initiation and conduction of nerve impulses by decreasing neuronal membrane permeability to sodium ions
Dose	1.5 mg/kg IV Max: 4 mg/kg/dose, 200 mg total
Administration	2% preservative free (cardiac) IV lidocaine 1.5mg/kg mixed in a 100mL bag run over 10 minutes
Compatibility	Compatible as an admixture with NS, D5W, and LR
PK/PD	Onset: 2-5 minutes[5] Duration: >90 minutes[6] Metabolism: hepatic Half-life: 1.5-2 hours[5] Excretion: urine (100%)
Adverse Effects	Bradycardia, cardiac arrhythmia, hypotension, headache, dizziness, confusion, local anesthetic toxicity syndrome (LAST)
Warnings and Precautions	Use with caution in severe hepatic dysfunction due to increased risk of toxicity
Monitoring	Cardiac telemetry for 30 minutes post-infusion

Overview of Evidence

Author, year	Design/ sample size	Intervention & Comparison	Outcomes & Conclusion
Soleimanpour et al., 2012	Prospective RCT (n=240)	Lidocaine 1.5 mg/kg IV vs morphine 0.1 mg/kg IV	• Lidocaine group had statistically significant lower pain scores (p=0.0001) • No clinically significant toxicity, some transient dizziness (8.3%) with lidocaine • **IV lidocaine is an effective option for renal colic with minimal side effects**
Firouzian et al., 2016	Prospective RCT (n=110)	Morphine 0.1 mg/kg IV + lidocaine 1.5 mg/kg IV vs morphine 0.1 mg/kg IV	• No statistically significant difference in pain scores between groups • Adding lidocaine to morphine resulted in faster pain relief and less nausea

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			• **Lidocaine can be used as a safe, effective, and inexpensive adjuvant to morphine to achieve nausea and pain relief**
Motamed et al., 2017	Prospective RCT (n=90)	Lidocaine 1.5 mg/kg IV vs fentanyl 1.5 mcg/kg IV	• Higher rates of treatment failure (lack of 3 points pain reduction) at 15 minutes after administration in lidocaine group (p=0.006) • No statistically significant difference in pain severity between groups • Lidocaine reduced pain scores from severe to mild or moderate within 5 minutes in 36% of patients, and the maximum analgesic effect was seen at 15 minutes • **Lidocaine does reduce renal colic pain, and the onset of pain relief may be quicker when used in combination with another analgesic**
Chinn et al., 2019	Prospective RCT (n=154)	Lidocaine 1 mg/kg IV vs hydromorphone 1 mg IV	• Superior pain relief achieved with hydromorphone compared to lidocaine (improvement in pain scores: 6.4 vs 3.4) • May have underdosed patients with 1 mg/kg rather than 1.5 mg/kg seen in other studies • **Lidocaine 1 mg/kg is inadequate to treat pain associated with nephrolithiasis**
Motov et al., 2019	Prospective RCT (n=150)	Lidocaine 1.5 mg/kg IV + ketorolac 30 mg IV vs lidocaine 1.5 mg/kg IV vs ketorolac 30 mg IV	• Ketorolac alone and in combination achieved superior pain reduction compared to lidocaine alone • Higher rates of adverse events in lidocaine-containing groups (dizziness, N/V) • **Lidocaine may be used as an adjunct to ketorolac in renal colic, but is associated with more side effects and has no analgesic superiority over ketorolac alone**

Conclusions

- If properly dosed, IV lidocaine is an effective and safe option for reducing pain in patients with renal colic.
- For full pain relief, lidocaine should be used in combination with other agents such as opioids or NSAIDs, as lidocaine may not be adequate to fully alleviate pain by itself.
- Using lidocaine can help spare NSAIDs and opioids in patients who may have contraindications to these agents.
- **Place in therapy:** 2nd line adjunctive agent after NSAIDs in the treatment of renal colic pain.

References

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