

1. Study Participants

Inclusion criteria	Exclusion criteria (One of follows)
Age: > 19 yrs ASA class I-III scheduled for elective VATS lobectomy	history of allergy to nefopam or NSAIDs, kidney dysfunction, liver dysfunction, myocardial infarction, closed angle glaucoma, pregnancy, woman on lactation, disagreement to use IV-PCA

* Allocate participants on the day before surgery

2. On the day of surgery

- * Recheck if the patient still wants to be enrolled for the study
- * Recheck if the written informed consent is signed appropriately.
- * Recheck if the patient still agrees to use IV-PCA

For all participants use anesthetic protocol as follows:

1. Monitoring: blood pressure, electrocardiography, pulse oximeter, SedLine®
2. Preoxygenation for 3 mins
3. Anesthetic induction : propofol 1.5-2 mg/kg IV, remifentanil 1 mcg/kg IV
4. Endotracheal intubation 2 mins after rocuronium 1 mg/kg IV.
5. Radial arterial cannulation with 20 G, Intravenous catheterization with 18G
6. Maintenance of anesthesia: sevoflurane 1.5-2.5 % (targeted for PSI 25-50)
7. One lung ventilation: Fraction of inspired oxygen was lowered to 50% for those with pressure of arterial oxygen above 150 mmHg, while it was maintained 100% for those with pressure of arterial oxygen less than 150 mmHg.

** Pain treatment as follows***

	Study group	
	Control	Nefopam
Nefopam	NONE	nefopam 20 mg + 100 mL mix administer 2 times (before surgical incision, at the end of surgery while chest tube insertion)
IV-PCA	Fentanyl 1200mcg (mixed with normal saline, 120 mL in total) 1 mL/h, 1 mL of bolus, 10 minutes of lock out time	
At the end of surgery	ketorolac 30 mg IV, and pethidine 0.5 mg/kg IV	
Postoperative pain control	> 4 VNRS : ketorolac 30 mg IV >6 VNRS : tramadol 50 mg IV	

3. Outcome measures

	0~1HR		1~6HR	6~12HR	12~24HR
Time	:	:	:	:	:
Pain at rest (VNRS 0-10)					
Pain with cough (VNRS 0-10)					
RSS					
Tachycardia (>HR 100)	Y / N	Y / N	Y / N	Y / N	Y / N
PONV	Y / N	Y / N	Y / N	Y / N	Y / N
Dizziness	Y / N	Y / N	Y / N	Y / N	Y / N
IV-PCA use					
Rescue analgesics	First opioid time(:)				

NEFO-VATS study

<QoR-15>

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

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