

This resource provides information that is beyond the basics about fentanyl-induced muscle rigidity (FIMR) or “wooden chest syndrome”. For basic information, check out

[FIMR: The Basics](#)

What is fentanyl-induced muscle rigidity?

Fentanyl-induced muscle rigidity (FIMR) is a complication of fentanyl use that causes rapid stiffening or spasm of the muscles used in breathing including the chest, neck, jaw, and upper airway.

What are the signs and symptoms of FIMR?

FIMR can be recognized by rapid onset (within 1-2 minutes of fentanyl use), muscle stiffness of the upper body, or resistance to airway insertion and ventilation from a clenched jaw, neck, or chest wall.

FIMR Signs & Symptoms (1 or more):

Muscle stiffness in the upper body: jaw, neck, chest wall and abdominal muscles

Vocal cord spasm that blocks upper airway (laryngospasm)

Clenched jaw that makes it difficult to insert oral airway

Rapid decrease in consciousness and cessation of breathing

Eyes open with fixed gaze, but unable to sit down or speak

Slumped over, with hyperextended neck

Decorticate posture (a type of abnormal involuntary body position)

- Arms flexed
- Legs extended with plantar flexion (toes pointed)
- Clenched fists

Is FIMR an emergency?

Yes, FIMR requires rapid intervention with naloxone and airway management. FIMR prevents breathing and oxygen intake. Muscle stiffness in the chest wall can prevent spontaneous and assisted ventilation. Jaw clenching and upper airway spasm can make airway insertion and ventilation difficult or impossible. FIMR usually responds quickly to naloxone, however, larger doses are often required to reverse the drug poisoning and resume breathing. .

How common is FIMR?

FIMR is a common overdose complication. The extreme concentrations of fentanyl in the toxic unregulated drug supply may contribute to increased rates of FIMR. However, exact numbers are difficult to determine.

How much fentanyl can cause FIMR?

FIMR can occur with any dose or route of administration, but is more likely to occur when fentanyl is used quickly and at high doses.

Other factors associated with FIMR include:

- Extremes of age (i.e., infants, elderly)
- Severe illness
- Neurologic or metabolic conditions (e.g. essential tremor)
- Combined use of substances that alter dopamine levels (e.g., cocaine, amphetamines, antidepressants, Parkinson's medications)

Considerations for responding to FIMR:

- Establish an airway and ensure adequate oxygenation. If unable to insert an airway or ventilate properly, administer naloxone immediately while troubleshooting ventilation[1].
- Consider giving a higher dose of naloxone (0.4mg-0.8 mg IM) and/or give more frequent doses (every 2 minutes) until an airway is inserted and ventilation and oxygenation is restored (e.g., SpO₂>95%).
- If the person is breathing normally on their own, help them into recovery position and avoid giving additional doses of naloxone, which could induce acute opioid withdrawal.
- When the person becomes alert, provide space, reassurance, and re-orientation to time and place.
- Sometimes vomiting occurs, which increases the risk for aspiration. If available, use suction to clear the airway and put the person in the recovery position.
- Sometimes muscle rigidity can have another cause. If the person does not respond to several doses of naloxone, consider other causes such as: high doses of substances that increase dopamine (e.g., bupropion), norepinephrine (e.g., stimulants) or serotonin (e.g., citalopram, fluoxetine); anticholinergic toxicity (e.g., zopiclone, sertraline); hemorrhagic stroke; and toxicologic, hypoxemic, or hypoglycemic related seizures.

Follow-up care

Monitor the person for 30-120 minutes following FIMR. If monitoring is not possible, discuss drug poisoning prevention safety planning including using with a buddy, use of the [Brave](#) or [Lifeguard](#) app, or calling the [National Overdose Response Hotline](#) 1-888-688-NORS.

How to Respond to an Opioid Poisoning

S
Stimulate

Check if they are responsive

- 1 Speak to them
- 2 Squeeze their fingertips or the muscle between the neck and shoulder

If they are not responsive call 9-1-1

A
Airway

- 1 Check if they are breathing normally
- 2 Check for a pulse (heartbeat)
- 3 Remove anything in their mouth

V
Ventilate

- 1 Lift chin and tilt head back
- 2 Give 1 breath every 5 seconds

E
Evaluate

- 1 Check breathing again
- 2 Check responsiveness
- 3 Check for a pulse

M
Medicate

Give naloxone if they are not breathing normally

- Inject 1 ampoule (0.4 mg) into arm or thigh muscle OR
- Give 1 intranasal spray (4 mg) in one nostril

E
Evaluate & Support

- 1 Keep giving breaths
- 2 Check breathing again
- 3 Give another dose of naloxone:
 - 3 minutes after last injection OR
 - 3-5 minutes after last intranasal spray

Responsiveness means:

- Awake and alert OR
- Easy to wake up

Breathing normally means:

- Taking 12 or more breaths per minute AND
- No unusual breathing sounds (e.g. gurgling)

If at any time:

There is NO PULSE:

Start CPR with rescue breathing and compressions

They start breathing normally:

- Place them on their side
- Do not leave them alone
- Repeat SAVE ME if their breathing changes
- STOP giving naloxone when they are breathing normally – even if they are still unresponsive

References

1. Burns G, DeRienz RT, Baker DD, Casavant M, Spiller HA. Could chest wall rigidity be a factor in rapid death from illicit fentanyl abuse? *Clinical toxicology* (Philadelphia, Pa). 2016;54(5):420-3.
2. Çoruh B, Tonelli MR, Park DR. Fentanyl-induced chest wall rigidity. *Chest*. 2013;143(4):1145-6.
3. Davis MP, Behm B. Reasons to avoid fentanyl. *Annals of palliative medicine*. 2020;9(2):611-24.
4. Dimitriou V, Zogogiannis I, Liotiri D, Wambi F, Tawfeeq N, Koumi A, et al. Impossible mask ventilation after an unusually low dose fentanyl-induced muscle rigidity in a patient with essential tremor: a case report and review of the literature. *Middle East journal of anaesthesiology*. 2014;22(6):619-22.
5. Gill H, Kelly E, Henderson G. How the complex pharmacology of the fentanyls contributes to their lethality. *Addiction*. 2019;114(9):1524-5.
6. Torralva R, Janowsky A. Noradrenergic Mechanisms in Fentanyl-Mediated Rapid Death Explain Failure of Naloxone in the Opioid Crisis. *The Journal of pharmacology and experimental therapeutics*. 2019;371(2):453-75.
7. Viscomi CM, Bailey PL. Opioid-induced rigidity after intravenous fentanyl. *Obstetrics and gynecology*. 1997;89(5 Pt 2):822-4.
8. Ahmad M, Raza T. "Jaws of Steel" After Very Low Dose of Fentanyl During Prebronchoscopy Sedation. *Journal of bronchology & interventional pulmonology*. 2017;24(1):e9-e10.
9. Buxton JA, Gauthier T, Kinshella MW, Godwin J. A 52-year-old man with fentanyl-induced muscle rigidity. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne*. 2018;190(17):E539-e41.
10. Kinshella MW, Gauthier T, Lysyshyn M. Rigidity, dyskinesia and other atypical overdose presentations observed at a supervised injection site, Vancouver, Canada. *Harm Reduct J*. 2018;15(1):64.
11. British Columbia Centre on Substance Use. Monthly Drug Checking Reports 2021 [updated July 2021; cited 2021 September 9]. Available from: <https://drugcheckingbc.ca/monthly-reports/>.
12. Akirov A. Adrenergic, Not Opioid Pathways, May Mediate Rapid Death From Fentanyl. *Clinical Pain Advisor*. 2019.
13. Bowdle TA. Adverse effects of opioid agonists and agonist-antagonists in anaesthesia. *Drug safety*. 1998;19(3):173-89.
14. Glick C, Evans OB, Parks BR. Muscle rigidity due to fentanyl infusion in the pediatric patient. *Southern medical journal*. 1996;89(11):1119-20.
15. Lynch RE, Hack RA. Methadone-induced rigid-chest syndrome after substantial overdose. *Pediatrics*. 2010;126(1):e232-4.
16. Roan JP, Bajaj N, Davis FA, Kandinata N. Opioids and Chest Wall Rigidity During Mechanical Ventilation. *Annals of internal medicine*. 2018;168(9):678.
17. Zibbell J, Howard J, Duhart Clarke S, Ferrell A, Karon S. Non-Fatal Opioid Overdose and Associated Health Outcomes: Final Summary Report. Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services; 2019.
18. Han Y, Yan W, Zheng Y, Khan MZ, Yuan K, Lu L. The rising crisis of illicit fentanyl use, overdose, and potential therapeutic strategies. *Translational psychiatry*. 2019;9(1):282.
19. Mayer S, Boyd J, Collins A, Kennedy MC, Fairbairn N, McNeil R. Characterizing fentanyl-related overdoses and implications for overdose response: Findings from a rapid ethnographic study in Vancouver, Canada. *Drug Alcohol Depend*. 2018;193:69-74.
20. Phua CK, Wee A, Lim A, Abisheganaden J, Verma A. Fentanyl-induced chest wall rigidity syndrome in a routine bronchoscopy. *Respiratory medicine case reports*. 2017;20:205-7.
21. U.S. Food and Drug Administration. Fentanyl Citrate Injection, USP: Akorn, Inc.; 2012 [Available from: https://www.accessdata.fda.gov/drugsatfda_docs/label/2013/016619s034lbl.pdf].
22. BC Drug and Poison Information Centre. Opioid Overdose Best Practices Guideline 2017 [Available from: http://www.dpic.org/sites/default/files/pdf/OpioidGuidelines_1Mar2017.pdf].
23. Vancouver Coastal Health. Opioid Overdose: Advanced Interventions in Supervised Consumption Settings 2019 [Available from: <http://shop.healthcarebc.ca/vch/VCHDSTs/D-00-13-30230.pdf>].
24. BC Centre for Disease Control. BCCDC Toolkit: Responding to Opioid Overdose for BC service providers 2020 [Available from: <https://towardtheheart.com/assets/uploads/1610668700M5CUWes9iDssX45XdoCISipddL2uVyX08CmViUF.pdf>].
25. Guidelines and Protocols Advisory Committee. Chronic Obstructive Pulmonary Disease (COPD): Diagnosis and Management 2017 [updated July 2020. Available from: https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/copd_full_guideline.pdf].
26. O'Donnell DE, Hernandez P, Kaplan A, Aaron S, Bourbeau J, Marciniuk D, et al. Canadian Thoracic Society recommendations for management of chronic obstructive p