Title: Safety and Efficacy of Midazolam alone Versus Midazolam with Ketorolac in Patient during Flexible Bronchoscopy

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Synopsis

For

FCPS Pulmonology

Safety and Efficacy of Midazolam alone Versus Midazolam with Ketorolac in Patient during Flexible Bronchoscopy

By

Dr Syed Haider Ali

PGR FCPS Pulmonology

Supervisor

Dr Muhmmad Hussain

Designation

Associate Professor

Department of Pulmonology Critical Care and Sleep Medicine, Services Hospital Lahore

To,

The Director,

Research Training and Monitoring Cell

College of Physicians and Surgeons Pakistan

7th Central Street, Phase II, DHA Karachi-75500

Subject: Submission of Synopsis

Respected Sir,

It is stated that I am sending a copy of my synopsis titled "Safety and efficacy of midazolam alone versus midazolam with ketorolac in patient during flexible bronchoscopy" as a requirement of FCPS II in Pulmonology. Kindly acknowledge and accept the same for the proposed study and research article writing.

Yours Sincerely,

Dr. SYED HAIDER ALI

RTMC Reg. No: PUL-2024-068-1019

SPECIALITY: Pulmonology

INSTITUTION: Services Hospital Lahore

TRAINEE'S SIGNATURE:

DATE: 06-january-2026

SUPERVISOR'S NAME: Dr. Muhammad Hussain

DESIGNATION: Professor of Pulmonology, Department of Pulmonology, Critical Care and Sleep Medicine, Services Hospital Lahore

NON DUPLICATION CERTIFICATE

I hereby certify that Dr. Syed Haider Ali having RTMC Reg. No: PUL-2024-068-1019 has been working as a post graduate resident in FCPS Pulmonology under my supervision in the department of Pulmonology, Services Hospital Lahore.

The enclosed synopsis titled:

Safety and efficacy of midazolam alone versus midazolam with ketorolac in patient during flexible bronchoscopy in a tertiary care hospital

Has been proposed for submission according to FCPS guidelines and under my supervision. I have read this synopsis and found it satisfactory for FCPS II examination in Pulmonology.

It is certified that this study is not duplicated in the same institute.

Signature of Supervisor

Name of Supervisor: Dr. Muhammad Hussain

Designation: Associate Professor of Pulmonology, Department of Pulmonology, Critical Care and Sleep Medicine

Date:

TO WHOM IT MAY CONCERN

This is to certify that **Dr. Syed Haider Ali** is conducting a study on Topic: **"*Safety and efficacy of midazolam alone versus midazolam with ketorolac in patient during flexible bronchoscopy in a tertiary care hospital*"** and there are no any ethical issues related to this study.

Dr. Muhammad Hussain

Associate Professor

Pulmonology Department

SIMS/Services Hospital Lahore.

Introduction

Flexible bronchoscopy has evolved into a vital diagnostic and therapeutic intervention in respiratory medicine due to its frequent and diverse applications [1]. It enables direct visualization of the tracheobronchial tree and facilitates procedures such as bronchoalveolar lavage, tissue sampling, and foreign body extraction. However, despite its clinical importance, the procedure is associated with patient discomfort due to airway manipulation, hypoxia, coughing and procedural pain. These discomforts can lead to poor patient cooperation, excessive movement, procedure related anxiety and even premature termination of the procedure, consequently affecting diagnostic accuracy and patient safety.

Multiple technique has been used should be improved procedural tolerance and adequate sedation is of the prime importance [2]. Sedation during bronchoscopy helps in reducing anxiety, suppressing the cough reflex, minimizing procedural duration and reduce overall complications. An ideal sedative agent should allow quick procedural recovery, ensuring patient comfort, procedural safety and overall diagnostic yield [3].

Sedative agents have dose dependent side effects including bradycardia, hypotension, respiratory depression, hypoxia which may lead to termination of procedure. Higher doses of topical analgesia with lignocaine can lead to seizures and bradycardia.

Multiple studies elaborate that addition of analgesia with some dose of sedation can improve patient tolerance and hence safety without additional side effects [4] . Similar findings have reported in gastroenterology and surgery units, where moderate sedation with analgesia not only improved the patient comfort and procedural cooperation but also reduced the peri-procedural anxiety, better patient satisfaction and decreased risk of procedure interruption [5].

Ketorolac tromethamine (Toradol) is a highly effective nonsteroidal anti-inflammatory drug (NSAID) with potent analgesic action without inducing respiratory depression [6]. When administered intravenously prior to bronchoscopy, ketorolac may reduce pain, improve comfort, and maintain cardiovascular stability [7][8]. It has a rapid onset and is generally safe to combine with sedatives such as midazolam. To ensure patient safety, individuals with known contraindications to NSAIDs, including bronchial asthma, are excluded from the present study.

This study therefore aims to compare the effects of midazolam alone versus midazolam combined with ketorolac on patient comfort, sedation quality, and safety during flexible bronchoscopy. The results may assist in designing a more effective and patient-friendly sedation strategy for bronchoscopy in Pakistan.

Rationale

Flexible bronchoscopy is an essential procedure in pulmonary medicine, but it is associated with discomfort, coughing, and anxiety. Adequate sedation and analgesia are vital to ensure patient cooperation, minimize stress, and improve diagnostic yield.

Midazolam is widely used due to its rapid action, anxiolytic properties, and amnestic effects; however, its lack of analgesic effect often leads to residual discomfort during the procedure. Ketorolac (Toradol), a nonsteroidal anti-inflammatory drug, provides effective analgesia while maintaining hemodynamic stability and without causing significant respiratory depression.

Hence, this study is warranted to determine whether ketorolac supplementation enhances patient experience, comfort, and procedural outcomes. The findings may support the development of a safer and more effective sedation protocol customized for our population.

OBJECTIVE

Compare the safety and efficacy of midazolam versus midazolam and ketorolac in patients undergoing flexible bronchoscopy.

Operational Definitions

1. Sedation:

A medically induced reduction in consciousness that enables bronchoscopy while maintaining spontaneous breathing and the ability to respond verbally and will be assessed by using **Ramsay Sedation Scale ,** a 6 point validated scale used to measure the patient's consciousness.

(Ramsay Sedation Scale)

1. Anxious, agitated, restless
2. Cooperative, oriented, tranquil
3. Responds to commands only
4. Brisk response to glabellar tap
5. Sluggish response
6. No response

2. Patient Comfort:

Patient will be asked to rate comfort 30mints after bronchoscopy using the Visual Analog Scale (VAS 0–10), where

0 = no comfort (very uncomfortable)

10 = maximal comfort.

MATERIAL AND METHODS

Study Design: This will be a randomized comparative study.

Setting: The study will be conducted in the Department of Pulmonology, Services Hospital, Lahore.

Duration: The study will span a period of 6 months following approval of the synopsis.

Sample size: A total of 50 patients will be included, with 25 patients allocated to each group.

Sampling technique: A non-probability purposive sampling technique will be used.

Inclusion criteria

1. Adults aged 18–75 years.
2. Patients undergoing flexible bronchoscopy.
3. ASA physical status I–III.
4. Patients able to provide informed written consent.

Exclusion criteria

1. History of bronchial asthma or NSAID-exacerbated respiratory disease (NERD).
2. Known hypersensitivity or contraindication to midazolam or NSAIDs (e.g., ketorolac).
3. Coagulopathy or platelet count < 70,000/μL.
4. Active peptic ulcer disease or diagnosed bleeding disorder.
5. Severe renal impairment CKD grade 3 or 4 with eGFR <50ml/min or hepatic failure.
6. Chronic opioid use or benzodiazepine dependency.
7. Unstable cardiorespiratory status (e.g., respiratory failure or requiring high-flow oxygen).

Data Collection Procedure

Following approval from the College of Physicians and Surgeons Pakistan (CPSP) and ethical clearance by the Institutional Review Board (IRB) of Services Hospital Lahore, eligible patients meeting inclusion criteria will be recruited after obtaining informed consent.

Participants will be randomly assigned into two groups:

Group A (Midazolam only):

Intravenous midazolam 0.05 mg/kg (maximum 5 mg), administered in divided doses 2.5mg bolus followed by 1.5mg and 1mg bolus if required. Each midazolam dose will be followed by saline bolus of 10 ml to facilitate rapid drug delivery.

Group B (Midazolam + Ketorolac):

Intravenous ketorolac 30 mg, will be administered 10–15 minutes before bronchoscopy. Intravenous midazolam 0.05 mg/kg (maximum 5 mg) administered in divided doses 2.5mg bolus followed by 1.5mg and 1mg bolus if required.

All procedures will be conducted by experienced pulmonologists under continuous monitoring of ECG, oxygen saturation (SpO2), and blood pressure. Supplemental oxygen will be administered to all participants. Patient comfort, sedation depth, and cooperation will be evaluated using standardized comfort and sedation scales. Any adverse events will be recorded. Data will be documented on a structured proforma for subsequent statistical analysis.

Data Analysis Procedure

Data will be entered and analyzed using SPSS (version 26). Quantitative variables such as age, sedation scores, and comfort levels will be expressed as mean ± standard deviation (SD). Qualitative variables including gender and adverse event frequencies will be presented as numbers and percentages. Independent Samples t-test will be used to compare mean comfort and sedation scores between the two groups. Chi-square test will be applied for comparing categorical variables such as gender distribution and incidence of adverse events. A p-value $\leq$ 0.05 will be considered statistically significant. Results will be displayed in tabular and graphical formats where applicable.

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Appendix I

Patient Data Performa

Study Title: Safety and efficacy of midazolam alone versus midazolam with ketorolac in patient during flexible bronchoscopy

Patient ID / Serial No: _____

Date: ____ / ____ / 20__

A. Demographic Information

Age (years): _____

Gender: Male / Female

Smoker status: Smoker / non-smoker

B. Clinical Information

Indication for Bronchoscopy: _____

ASA Physical Status: I / II / III

Comorbidities: _____

C. Study Group Allocation

Group A (Midazolam Only):

• Midazolam 2.5 mg IV → then 1.5 mg IV → then 1 mg IV (Total = 5 mg)

Group B (Midazolam + Ketorolac):

• Midazolam 2.5 mg IV → then 1.5 mg IV → then 1 mg IV (Total = 5 mg)

• Ketorolac 30 mg IV (single dose)

Time of Administration: _____

E. Procedure Details

Start Time: _____

End Time: _____

Total Duration (min): _____

Appendix II

Sedation & Analgesia Assessment Performa

Patient ID: _____

Group: A / B

A. Sedation Level (Ramsay Sedation Scale)

1. Anxious, agitated, restless

2. Cooperative, oriented, tranquil

3. Responds to commands only

4. Brisk response to glabellar tap

5. Sluggish response

6. No response

B. Pain/Discomfort Score (VAS 0–10)

30 Minutes After: _____

C. Patient Tolerance

Score: _____

D. Complications / Adverse Events

List any complications: _____

E. Operator Satisfaction (Likert scale)

Score: _____

F. Outcome

Procedure completed successfully? Yes / No

Reason if No: _____