**STUDY IDENTIFICATION / CITATION**

**Author**
- Ameer, B.
- Burlingame, M. B.
- Harman, E. M.
- Bosslet, G.
- Housset, B.
- Fuhrman, C.
- Atassi, K.
- Antoniades, N.
- Burlingame, M. B.

**STUDY TYPE**
- Qualitative research

**POPULATION CHARACTERISTICS**

**INTERVENTION**
- Relationship of age and plasma lidocaine concentration in patients undergoing bronchoscopy.
- Premedication with midazolam and fentanyl.
- Lidocaine gargle; 2% lidocaine spray to oropharynx; 1% lidocaine gel to nose; 1% lidocaine to bronchial tree.

**Comparison**
- Young versus Elderly

**Follow Up**
- Until 24-hours post bronchoscopy

**OUTCOMES**
- Dose of lidocaine administered; plasma lidocaine concentration; signs of toxicity

**Effect size**
- Similar overall amounts of lidocaine administered (Young vs. Elderly) 19.03mg/kg vs. 17.51mg/kg; mild objective and subjective findings of possible toxicity were not related to plasma concentration and not different between groups (nausea/vomiting, drowsiness, lightheadedness, occasional ecotops, shortness of breath). Mean maximum lidocaine concentration 3.04 vs. 2.40mcg/ml. No plasma concentrations in excess of 5mcg/ml.

**Funding**
- Not stated

**Comments**
- High overall doses of lidocaine administered appear equally safe for patients aged 30-50 years and 60-75 years. Mean maximum lidocaine concentrations were seen (3.04, 2.40mcg/ml). No plasma concentrations in excess of 5mcg/ml. If lidocaine gargle is assumed not to be absorbed, mean total dose was 10.6mg/kg.

**STUDY IDENTIFICATION / CITATION**

**Author**
- Antoniades, N.
- Worsnop, C.

**STUDY TYPE**
- Randomized controlled trial

**POPULATION CHARACTERISTICS**

**INTERVENTION**
- Bronchoscopy with either lidocaine or placebo (normal saline) to larynx, vocal cords and tracheobronchial tree. All patients had topical lidocaine gel to nose and 6 sprays of co-phenylcaine spray to oropharynx.

**Comparison**
- Between treatment and placebo

**Outcomes**
- Primary outcome not defined. Frequency of cough and stridor measured using recorder.
- VAS assessment of amount of coughing and cough interference with bronchoscopy (separately by doctor and nurse).
- Sedation requirement (midazolam and fentanyl).

**Effect size**
- Significant changes: cough rate decreased from 27.50/min (placebo) to 12.20 (lidocaine); stridor rate reduced from 0.80 (placebo) to 0.22 (lidocaine).
- VAS-assessed cough scores were lower for lidocaine, as assessed by nurses and doctors. Less midazolam required for lidocaine arm (2.1mg vs 3.4mg) and less fentanyl required for lidocaine arm (81.9mg vs 98.4mg).

**Funding**
- Not stated

**Comments**
- Airway local anaesthesia with lidocaine is associated with a significant improvement in cough and stridor rate. Lower doses of midoal and fentanyl are needed when lidocaine is used.

**STUDY IDENTIFICATION / CITATION**

**Author**
- Atassi, K.
- Mangiapani, G.
- Lary, S.
- Doshi, P.
- Housset, B.

**STUDY TYPE**
- Prented equiinal carbon dioxide and oxygen mixture reduces discomfort during flexible bronchoscopy in adult patients: a randomized, controlled, double-blind trial

**POPULATION CHARACTERISTICS**

**INTERVENTION**
- Bronchoscopy with either lidocaine or placebo (saline).

**Comparison**
- Between treatment and placebo

**Outcomes**
- Primary outcome pulse rate and BP (Tyslotic) during the procedure.
- Secondary outcomes were self-assessed pain using a 10cm visual analog scale (VAS) and patient assessment of willingness to undergo repeat procedure, nasal pain, cough and most painful part of procedure.

**Effect size**
- No plasma concentrations in excess of 5mcg/ml. Mean maximum lidocaine concentration 4.12mcg/ml.

**Funding**
- No plasma concentrations in excess of 5mcg/ml. If lidocaine gargle is assumed not to be absorbed, mean total dose was 10.6mg/kg.

**Comments**
- No plasma concentrations in excess of 5mcg/ml. If lidocaine gargle is assumed not to be absorbed, mean total dose was 10.6mg/kg.

**STUDY IDENTIFICATION / CITATION**

**Author**
- Bosslet, G.
- Deivioto, ML.
- Lahm, T.
- Shilkis, FD.
- Mathur, PN

**STUDY TYPE**
- Nurse-administered propofol sedation: feasibility and safety in bronchoscopy.

**POPULATION CHARACTERISTICS**

**INTERVENTION**
- Sedation for bronchoscopy using NAPS.
- All patients were sedated by a non-anaesthetic nurse who had been trained in propofol use to achieve moderate sedation. Patients received nasal cannula oxygen 4-6/min; 2-mg midazolam iv, fentanyl 25 mcg/mcg iv, then bolus of propofol (20-40mg), followed by boluses of 10-20mg iv every minute to achieve moderate sedation.

**Comparison**
- No comparisons.

**Outcomes**
- Bronchoscopy record only analysed

**Effect size**
- Adverse events, propofol dose, procedure time

**Funding**
- Not stated

**Comments**
- Nurse administered propofol sedation for bronchoscopy, after a formal training course, appears to be associated with reasonable adverse event profile.
<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Journal</th>
<th>Year</th>
<th>Study Type</th>
<th>n</th>
<th>Sedation</th>
<th>Bronchoscopy</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowl CT,</td>
<td>Krugel BR</td>
<td>Chest</td>
<td>2000</td>
<td>RCT</td>
<td>217</td>
<td>Placebo</td>
<td>Elective outpatient bronchoscopy.</td>
<td>No significant benefit to any agent reported by bronchoscopy/anaesthetist/patient for secretion control/cough suppression/overall patient comfort, apart from patient assessment of secretion control for glycopyrolate, but this was not a consistent pattern. 5 episodes of tachycardia, not seen with placebo.</td>
</tr>
<tr>
<td>Clarkson,</td>
<td>Power, C.</td>
<td>CHEST</td>
<td>1993</td>
<td>RCT</td>
<td>44</td>
<td>Placebo</td>
<td>Sedation with midazolam (2mg bolus + 1mg atropine), upper airways (0.1mg atropine) or 10mg lidocaine</td>
<td>Propofol appears to be superior to midazolam in this group of patients, offering rapid sedating effects and recovery time. Patients were not sedated to a well defined level (ptosis only), and high midazolam doses appeared to be used limiting definitive conclusions.</td>
</tr>
<tr>
<td>Frey, J. G.</td>
<td>O'Connell, F.</td>
<td>CHEST</td>
<td>2009</td>
<td>RCT</td>
<td>84</td>
<td>Propofol</td>
<td>Midazolam administered topically to pharynx (1000mg), upper airways (100mg) and intravenously (50mg). Oxygen was only administered if saturations &lt;92%. Sedation given by 40mg propofol (propofol randomised arm) or 2mg midazolam (midazolam randomised arm), with boluses of 20mg propofol or 2mg midazolam &gt;=2mins apart until electroencephalographic bispectral index (BIS) was between 70-85, at which point bronchoscopy started.</td>
<td>Recovery time to BIS &gt;90 was significantly (p&lt;0.001) faster for propofol (5.4±4.7mins) versus midazolam (11.7±10.2mins). No significant differences between groups for adverse events (including hypotension), although two patients in midazolam group required ventilatory support due to desaturation, and an obese patient with moderate COPD required intubation. All CPT variables favoured propofol at 15 mins, and reaction time and incorrect responses remained significantly improved at 1 hour for propofol. Operator VAS assessment of &quot;global tolerance&quot; was comparable but patient assessment favoured propofol, reaching significance in a number of domains. Patient cough assessment was similar in both arms.</td>
</tr>
</tbody>
</table>
### Comparison of midazolam with propofol for sedation in outpatient bronchoscopy

**1993 BRITISH JOURNAL OF ANAESTHESIA**

<table>
<thead>
<tr>
<th>Study Details</th>
<th>Journal Details</th>
<th>Study Design</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 patients in each arm (propofol vs. midazolam)</td>
<td>419-22 RCT</td>
<td>Double-blinded allocation to iv propofol or midazolam bolus. Topical lidocaine as per protocol. Bronchoscopists and patients were blinded to drug. Sedated until had closed eyes but were rousable to command.</td>
<td>Between treatment</td>
</tr>
</tbody>
</table>

### Bronchoscopy Journal of Medicine

<table>
<thead>
<tr>
<th>Study Details</th>
<th>Journal Details</th>
<th>Study Design</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 in placebo; 20 in clonidine arm</td>
<td>746-51 RCT</td>
<td>Premedication with clonidine (3mg/kg) or placebo 15 mins prior to bronchoscopy, followed by topical anaesthesia only</td>
<td>Placebo comparison</td>
</tr>
</tbody>
</table>

### Assessment of patient satisfaction and lidocaine requirement during flexible bronchoscopy without sedation

**2009 Journal of Bronchology**

<table>
<thead>
<tr>
<th>Study Details</th>
<th>Journal Details</th>
<th>Study Design</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 consecutive patients, Indian mean age 49.48, 49 male, 21 female. Biopsies undertaken in 27 patients.</td>
<td>176-179 Qualitative research</td>
<td>Consecutive patients undergoing flexible bronchoscopy without sedation, using lidocaine topical anaesthesia (15% lidocaine spray, 4% lidocaine to nose, 2% lidocaine jelly to scope, 4% lidocaine to cords and 2% lidocaine in airways). No comparisons</td>
<td>1 hour post bronchoscopy</td>
</tr>
</tbody>
</table>

### Requirement of sedation during flexible bronchoscopy among substance and nonsubstance users

**2006 Journal of Bronchology**

<table>
<thead>
<tr>
<th>Study Details</th>
<th>Journal Details</th>
<th>Study Design</th>
<th>Key Findings</th>
</tr>
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<tbody>
<tr>
<td>50 in each arm (substance users vs. nonsubstance users)</td>
<td>58-60 Cohort</td>
<td>Substance user vs. nonsubstance user - Male/Female 32/18 vs. 25/25. Age significantly different - majority 18-40 vs. &gt;60. Retrospective cohort study. Patients with a history of substance user (heroin and/or cocaine) vs. matched patients (having bronchoscopy same or next day). Level of sedation routinely to Ramsay 3-4. Given poor age matching, patients allocated to three age groups.</td>
<td>History of substance use vs. no such history</td>
</tr>
</tbody>
</table>

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*BTS Guideline for diagnostic flexible bronchoscopy in Adults*  
Evidence Tables for Premedication, Sedation & Topical Anaesthesia  
*3*
Hospitalised patients with pre-existing stable respiratory failure requiring bronchoscopy. Respiratory failure defined as PaO2 <60 mm Hg and/or PaCO2 >45 mm Hg on air. Midazolam/Midazolam n/Affentanil - male/female (18/5/12/3); age 63.4±5.7; pCO2 41.2±45.7 mm Hg; pO2 55.0±48.0

Hospitalised patients with midazolam or midazolam/affentanil for patients with type 1 or 2 respiratory failure

Bronchoscopy with 2mg iv midazolam (initial dose) compared with bronchoscopy with 2mg iv midazolam (initial dose) + 0.5mg iv alfentanil. Not sedated to a defined level. This followed local anaesthesia with oxybuprocaine (dose and protocol not specified).

Until none of the following - increased amount of oxygen supply compared to pre-intervention conditions, pH <7.35, change in PaCO2 >10 mm Hg compared with pre-intervention values or an ALDRETE score <9.

Doctor and patient VAS assessment of global tolerance, nausea, ease of introduction, asphyxia, cough and pain. Tolerance score defined as mean of global tolerance and mean of 5 other sensations. ASA grade used for overall physical status. ALDRETE score used to assess recovery after bronchoscopy. ABG and transcutaneous pCO2 monitored (primary endpoint). Secondary endpoints - need for prolonged monitoring (defined on basis of pH, change in pCO2 and ALDRETE score), patients' tolerance score, time until ALDRETE score >9.

Importantly, midazolam group received a median of 4mg of midazolam vs. 2mg for midazolam/affentanil arm. No significant difference between pCO2 during bronchoscopy. Oxygen saturations in midazolam/affentanil group started lower, and remained lower during bronchoscopy. No consistent differences in rate of recovery or time taken to reach ALDRETE score >9. Prolonged monitoring for 1 patient only (midazolam/affentanil arm). Patient and physician VAS assessment was improved in all domains for midazolam/affentanil, reaching significance for patients for asphyxia and pain, and reaching significance for doctors in all domains other than ease of introduction.

In a small cohort study of patients with either type 1 or 2 respiratory failure, there was no clear worsening of peak pCO2 during bronchoscopy when alfentanil was added to midazolam, although there was a significant increase for both groups (change of approximately 9-11mm Hg interpreted from graph; numerical data not given). Despite a lower median dose of midazolam in the midazolam/affentanil arm (2mg vs. 4mg), patient and physician VAS satisfaction assessments (multiple domains) were improved in all domains for midazolam/affentanil, reaching significance for a number. Results should be tempered by lack of placebo group, and cohort nature of study.

**Evidence Tables for Premedication, Sedation & Topical Anaesthesia**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Journal</th>
<th>Cohort</th>
<th>Patients</th>
<th>Study Design</th>
<th>Intervention</th>
<th>Outcome Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cochrane, G. M.</td>
<td>2010</td>
<td>RESPIRATION</td>
<td>15 in each arm (midazolam vs. midazolam/affentanil)</td>
<td>Hospitalised patients with pre-existing stable respiratory failure requiring bronchoscopy. Respiratory failure defined as PaO2 &lt;60 mm Hg and/or PaCO2 &gt;45 mm Hg on air. Midazolam/Midazolam n/Affentanil - male/female (18/5/12/3); age 63.4±5.7; pCO2 41.2±45.7 mm Hg; pO2 55.0±48.0</td>
<td>Premedication, Sedation &amp; Topical Anaesthesia</td>
<td>Patient study - mean total dose of 0.23mg, 9.3mg/kg, giving an average peak plasma concentration of 2.9mg/L. Two patients had levels &gt;5mg/L, but were asymptomatic. Peak concentrations only correlated with dose, and smoking/patient volume/predicted FEV1 did not influence peak plasma concentrations. Average time to peak was ~45mins. Volunteer study - 4% lidocaine gargle+swallow associated with higher peak plasma concentration than 10% aerosol (2.4mg/L vs. 1.9mg/L, p&lt;0.05); Lidocaine aerosol 10% to nose gave higher peak plasma levels than 2% lidocaine gel (0.8 vs 0.52mg/L, p&lt;0.05).</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Journal</th>
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<th>Patients</th>
<th>Study Design</th>
<th>Intervention</th>
<th>Outcome Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efthimiou, J.</td>
<td>1982</td>
<td>THORAX</td>
<td>Qualitative research</td>
<td>41 patients, 10 volunteers. 41 patients - no liver disease, with normal haematological and biochemical bloods. 10 volunteers - no further details.</td>
<td>Plasma lidocaine concentrations until 180 mins post bronchoscopy. Patients received premedication with atropine and atropine im. 32 patients received 10% lidocaine spray to nose; 9 patients received 2% lidocaine gel. Lidocaine (1% or 4%) 'spray as you go' was recorded. Volunteer study (no bronchoscopy) - 5 volunteers gargled+drank 4% lidocaine solution; 5 volunteers had 10% lidocaine spray (both giving similar dose of 6.8mg/kg). Separately, 5 volunteers received nasal 10% lidocaine and a different five received 2% lidocaine gel (both of similar dose of 2.2mg/kg). Bloods taken until 2 hours afterwards.</td>
<td>Plasma lidocaine concentrations</td>
<td>Until 3 hours post bronchoscopy</td>
</tr>
<tr>
<td>Name</td>
<td>Journal</td>
<td>Year</td>
<td>Type</td>
<td>Arm 1</td>
<td>Arm 2</td>
<td>Conclusion</td>
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<tr>
<td>Fox, BD, Kryc, V</td>
<td>RESPIRATORY MEDICINE</td>
<td>2008</td>
<td>RCT</td>
<td>120 patients randomised with 60 in each arm</td>
<td>120 patients randomised with 60 in each arm</td>
<td>The study demonstrated that patients in the propofol + topical lidocaine group experienced less sedation and opioid use compared to the placebo group.</td>
<td></td>
</tr>
</tbody>
</table>
O'Driscoll, Ronan
Cooke, N. J.
Mellor, E.
MM †; sh,
Adina Ahmad
Roslina Abdul
PhD†; M   p,
Roslan MRCP,
Fauzi Abdul
Monie, R. D.
Greig, J. H.

midazolam
alfentanil with
double blind
bronchoscopy:
for
fibreoptic
Bronchoscopy
and Satisfaction
Suppression
Equivalence of
bronchoscopy
-2004
1994
2008
2008
1994
2004
2004
2004
6

12 patients randomised. Further characteristics not given.

Double-blind allocation to sedation with either midazolam (tratted to weight -2/3/kg; additional boluses as required) + placebo OR alfentanil 0.5mg (additional 0.25mg boluses as required) + placebo (tratted to weight) OR midazolam (tratted as above; additional boluses as required) + alfentanil 0.5mg. Level of sedation not protocolised. Lidocaine given in protocolised manner. Patients not routinely given oxygen.

Between treatment
2 hours post bronchoscopy
No power calculation. No primary outcome specified. Cough rate, additional aliquots of lidocaine; duration of procedures; recovery time; patient and physician VAS assessed discomfort.

Mean sedation given - M/P: H-5.7mg, M/A=4.5mg A=6.5mg, P/A=4.5mg; Sedation - M/P=8.5ml, M/A=4.5ml, P/A=1ml. Coughs/min M/P=2.45, M/A=1.7, P/A=1.42 (M/P vs. P/A p=0.003). Other values not given. More lidocaine used for M/P than other groups, p=0.005. No significant differences in VAS scores. Minimum fall in O2 saturations M/P 9.6%, M/A=13.5%, P/A 8.6% (M/A vs. P/A p=0.03). Immediate' recovery time for all regimens.

Hutton, M. Q.
Allen, M. B.
Mellor, E.
Coote, N. J.

Does sedation help in fibreoptic bronchoscopy?

Randomised-controlled Trial to Study the Equivalence of 1% Versus 2% Lignocaine in Cough Suppression and Satisfaction During Bronchoscopy

12 patients 2% lidocaine; 29 patients 2% lidocaine

Lidocaine 5% 6 sprays to oropharynx 5ml lidocaine 2% to nose; oxygen via nasal cannula at 2-5L/min; 1-2mg/hr lidocaine. Study intervention - 1% vs. 2% lidocaine local delivered as 'spray as you go' 2ml each time - 4x to vocal cords, 1x to carina, 1x each upper lobe bronchus, with extra aliquots as required.

Between treatment
Until fully alert and conscious'
Cough count, physician VAS assessment of tolerance and cough; patient VAS assessment of tolerance and cough; total dose of lidocaine

1% vs. 2% - cough count 187 vs. 304 (ns), total lidocaine dose 16mg vs. 14mg (p=0.001), total volume of lidocaine 36.1 ± 17.0ml (ns), total midazolam dose 2.0 vs. 2.0mg (ns). No significant differences for any VAS score - physician tolerance VAS 2.2 vs. 1.1; physician cough VAS 2.3 vs. 2.4; patient tolerance VAS 0.75 vs. 1.2; patient cough VAS 2.0 vs. 2.9 (lower is better for all VAS scales).

Houghton, Catherine M.
Raghuram, Ananthakrishna
Sullivan, Paul J.
O'Driscoll, Ronan

Pre-medication for bronchoscopy: a randomised double blind trial comparing alfentanil with midazolam

68 patients, 40 randomised to alfentanil arm, 29 randomised to midazolam. Unclear why uneven recruitment given that randomisations were done in blocks of 20 (ten of each in a block).

Patients requiring flexible bronchoscopy at a university hospital, having a variety of wash, brush, biopsy and BAL. No other patient characteristics given.

Comparison of sedation for bronchoscopy with either alfentanil or midazolam. Patients were given a starting dose of 0.5-1 mg of alfentanil or 2.5-5 mg of midazolam by an independent non-blinded physician. Incremental doses were given as needed to optimise patient comfort on the instruction of the blinded operator. Patients received topical nasal lidocaine gel and topical 2% lidocaine applied to the vocal cords and bronchial tree.

Between treatment
Until 24 hours post bronchoscopy
No power calculations. 7-point Likert scale for patient assessment of comfort, same scale for bronchoscoptist, ease of procedure recorded on 6-point Likert scale, patient cough level documented on 5-point Likert scale, same nose-throat-lung discomfort score at 24 hours and asked about drowsiness, cough, nose soreness, throat soreness, feeling sick and vomiting (none/mild/moderate/severe), willingness to have procedure again on 4-point Likert scale. Safety judged by level of desaturation and amount of topical anaesthesia.

Difficult to come to certain relevance of outcomes due to lack of primary outcome, power calculation and multiple comparisons. No improvement in patient or physician (Likert-assessed) scores of discomfort or physician Likert-assessment of procedure ease immediately post-procedure but some scores (nasal and throat) were possible lower with more possible higher drowsiness assessment for midazolam arm -24 hours post procedure. This should be interpreted with caution given the evidence of pain (lower is better for all VAS scales).

Not stated

Subjective and objective patient and physician assessment of cough amelioration with either 1% or 2% 'spray as you go' lidocaine reveals no benefit to 2%, but an increase of total dose from 3.5 mg/kg to 6.5mg/kg for 2% (without adverse event).

Not stated

Sedation with phenoperidine/droperidol is associated with a greater ease of bronchoscopy for physicians. For midazolam, patient assessed comfort was not improved, nor was overall willingness to repeat, although patients were not sedated to a clearly defined level, and study included no power calculation to determine number of required patients. Phenoperidine and droperidol is associated with increased reluctance to undergo further bronchoscopies.

Not stated

Aflentanil may be associated with less physician-assessed cough than midazolam, but this did not manifest as improved ease of procedure or patient assessment of procedure, but conclusions are limited due to study limitations.
Isaac, P. A. Barry, J. E. Vaughan, R. S. Rosen Newcombe, M. G. 1990 ANAESTHESIA RCT * A jet nebuliser for delivery of topical anaesthesia to the respiratory tract. A comparison with cricothyroid puncture and direct spraying for bronchoscopic anaesthesia. 54 patients total; random allocation to nebulised lidocaine (30) or sprayed lidocaine (24).

Keane, D. McNeillachas, W. 1992 EUROPEAN RESPIRATORY JOURNAL RCT * Comparison of nebulized and sprayed topical anaesthesia for fiberoptic bronchoscopy. 54 patients age 17 to 70; sex M/F 17/36; smokers 9/30 vs. 11/24; asthma 11/50 vs. 14/24.

Kortilla, K et al. 1978 BJA Qualitative research * Effect of Age on Amnesia and Sedation Induced by Flunitrazepam during local anaesthesia for bronchoscopy. 79 patients; 19 patients less than 40 years old; 62 patients 40-59 years old; 19 patients 60-69 years old; 15 patients >70 years old.

Evaluation of the efficacy of nebulised lignocaine as adjunctive local anaesthesia for fibreoptic bronchoscopy: a randomised, placebo-controlled study

83 patients randomised to either nebulised normal saline, nebulised 60mg lignocaine or nebulised 120mg lignocaine. Mean age 55.6±2.1 in the three arms. Not stated relevant indication for bronchoscopy, or whether patient/outpatient.

83 patients randomised to either nebulised normal saline, nebulised 60mg lignocaine or nebulised 120mg lignocaine. Unclear how randomised and also whether each arm had equal chance of being chosen. Patients received incremental iv midazolam, and importantly some received iv fentanyl (with differential rates in each group). Patients also received topical 5mg of topical lignocaine as a "laryngopharyngeal" spray, cetrizine 25mg iv, 4ml 4% lignocaine and direct application of 4ml 4% to vocal cords (total of 290mg lignocaine). Study unclear as to whether 3ml or 5ml of nebulised solution was given. All bronchoscopy via mouth. Patients given 30mg sublingual diaspam and nebulised salbutamol/spratropium bromide prior.

Between treatments and placebo

Until end of bronchoscopy

Primary outcome unclear: bronchoscopist and nursing staff used VAS assessed ease of procedure and cough

No additional topical lignocaine administered in any group. 45% of patients received fentanyl in saline arm, 37.5% in 60mg lignocaine arm and 21% in 120mg lignocaine arm and this may cause significant confounding. No difference in VAS assessed ease of procedure or perception of cough.

Not stated

No significant methodological limitations (randomisation unclear, no power calculation, lack of stated primary outcome, variably reported amounts of volume of solution for nebulising) and confounding with differential use of fentanyl means that any results lack relevance.
### Mainland, P. A. Kong, A. S. Chung, D. C. Chan, H. Lui, C. K.

#### Absorption of lidocaine during aspiration anaesthesia of the airway

<table>
<thead>
<tr>
<th>Journal</th>
<th>Volume</th>
<th>Issue</th>
<th>Pages</th>
<th>Study Design</th>
<th>Patients</th>
<th>Sedation/no sedation</th>
<th>Sedation for bronchoscopy</th>
<th>Outcome Measures</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOURNAL OF CLINICAL ANESTHESIA</td>
<td>44(6)</td>
<td>RCT</td>
<td>++</td>
<td>Stage 1 (lidocaine solutions of varying concentrations): 48 patients total (15 in 1% 0.2ml/kg arm [A]; 16 in 1.5% 0.2ml/kg arm [B]; 16 in 2.0% 0.2ml/kg arm [C]). Stage 2 (determined by experience of bronchoscopy): 48 patients total (of whom 33 agreed to blood sampling for lidocaine levels; 16 patients in 2% 0.2ml/kg arm [C]; 16 in 1% 0.3ml/kg arm [D]; 16 in 2% 0.3ml/kg arm [E]).</td>
<td></td>
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</tbody>
</table>
Anticholinergic premedication for flexible bronchoscopy: a randomized, double-blind, placebo-controlled study of atropine and glycopyrrrolate

**Malik, David**

Ahmad Surindar N., Dhania Agarwal, Ashutosh P., Aadit, Surinder Jindal, Ashutosh N. Malik, Javid

*CHEST* 1996 100 patients undergoing diagnostic flexible bronchoscopy, 339 atropine arm, 336 glycopyrrrolate arm, 325 placebo arm. No power calculation stated.

Mean age 48.8±10.4, male 66, 47.0±8.7, variety of operators. All inpatients and outpatients >15 years of age were eligible. Patients who had previously participated in any similar study, patients undergoing brachytherapy or therapeutic bronchoscopy for removal of secretions, patients with a history of glaucoma or prostatic disorders, patients with <90% baseline oxygen saturation on finger pulse oximetry, patients using oxygen supplementation, and intoxicated patients were excluded.

Patients received either atropine 0.01mg/kg, glycopyrrrolate 0.005mg/kg or placebo 2ml normal saline IM 20-40 mins prior to bronchoscopy. Unclear how patients were randomised. Patients also received iv midazolam 0.07mg/kg, titrated as required to achieve ‘light sedation’. Nebulised lidocaine 4% was used for airway anaesthesia, but amount not stated. Not stated whether further upper airway topical anaesthesia used, although 5ml 2% lignocaine said to be instilled into trachea via spray as-you-go and additional boluses ‘as required’ in a non-protocolised manner. Additional doses not reported in study.

Between treatment and placebo

<table>
<thead>
<tr>
<th>Event</th>
<th>Baseline</th>
<th>Atropine</th>
<th>Glycopyrrrolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSA desaturation, procedure time and adverse events were compared.</td>
<td>0.005</td>
<td>0.02</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

**Maltais F, Luberge F, Laviolette M**

A randomized, double-blind, placebo-controlled study of lorazepam as premedication or bronchoscopy

1996 *Chest* 1195-198 RCT 49 - placebo arm, 51 - lorazepam arm Placebo/Lorazepam: Age 59 vs. 63, Sex 32/17 vs. 37/14, duration - 7 vs. 6.9. Excluded those having BALT/TBB, those >80yrs.

Premedication with placebo or lorazepam (1) 1.5hr prior to bronchoscopy. No data on amount of lidocaine used.

Placebo comparison

Day after bronchoscopy

Primary outcome not stated. No power calculation. Patient assessment of bronchoscopy (very easy/easy/difficult/very difficult) tolerance, level of sedation (appropriate/excessive/insufficient), willingness to undertake second bronchoscopy (yes/only with physician insistence/no, never again), recollection of procedure (clear/indistinct/not at all).

No differences between groups immediately after bronchoscopy, but at 24 hours more placebo patients reported that the procedure was difficult or very difficult (60.3% placebo, 38.0% - lorazepam, p=0.005) and more placebo patients would be reluctant to have a repeated bronchoscopy (p=0.005).

**Martin KM, Larsen PD, Segal R, Marsland CP.**

Effective nonanatomical endoscopy: training produces clinical airway endoscopy proficiency

2004 *Anaesthesia and Analgesia* 938-44 Qualitative research 49 volunteers, 3 withdrew prior to course, 1 unwilling to undergo bronchoscopy Volunteers from Department of Anaesthesia, further details not given.

Data from course evaluating efficacy of training techniques for bronchoscopy. All volunteers given 5mg/kg lidocaine, 150mg prior to bronchoscopy. No sedation. Airway anaesthesia with 2% viscous gargle, 2% aerosolised solution, 10% spray and 2% spray-as-you-go lidocaine.

None

Until after bronchoscopy

Relevant outcomes - VAS assessment of local anaesthetic. Side effects. Total dose of lidocaine.

<table>
<thead>
<tr>
<th>Event</th>
<th>Baseline</th>
<th>Placebo</th>
<th>Lidocaine</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS of ‘being willing to undertake bronchoscopy’</td>
<td>80</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Median VAS of ‘being willing to undertake second bronchoscopy’</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Mean duration of lidocaine</td>
<td>17 mins</td>
<td>17 mins</td>
<td>17 mins</td>
</tr>
<tr>
<td>Median VAS of ‘being willing to undertake third bronchoscopy’</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Mean duration of lidocaine</td>
<td>17 mins</td>
<td>17 mins</td>
<td>17 mins</td>
</tr>
<tr>
<td>Mean VAS of ‘being willing to have second bronchoscopy’</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Mean duration of lidocaine</td>
<td>17 mins</td>
<td>17 mins</td>
<td>17 mins</td>
</tr>
<tr>
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</tr>
<tr>
<td>Mean duration of lidocaine</td>
<td>17 mins</td>
<td>17 mins</td>
<td>17 mins</td>
</tr>
</tbody>
</table>

For volunteers given a median of 8.6mg/kg lidocaine (range 7.1-14.77), subjective probable lidocaine side effects, including mood elevation, depression, impaired cerebration and visual changes, are common in this study, although patients also received is glycopyrrrolate. Objective side effects, including tremolouences and single involuntary limb movements were seen in 3/39.

BTS Guideline for diagnostic flexible bronchoscopy in Adults

Evidence Tables for Premedication, Sedation & Topical Anaesthesia

10
**Patient satisfaction with conscious sedation for bronchoscopy**

**Methodology**
- **Participants**: 50 patients
- **Intervention**: Lidocaine spray or atropine
- **Control**: No sedation
- **Randomization**: Randomized
- **Blinding**: Double-blind
- **Outcomes**: Patient satisfaction

**Results**
- Significantly higher satisfaction with lidocaine spray

**Conclusion**
- Lidocaine spray is preferred by patients for bronchoscopy.
Propofol versus fospropofol plus hydrocodone for flexible bronchoscopy: a randomised study.


Schwarz Y, Greif L, Lurie O, Tarrauch H, Weinbrum AA
Ontoxtomethyran premedication reduces midazolam requirement: objective and subjective parameters in peribronchoscopy

2007 Respiration 314-319 RCT - 60 consecutive patients OM vs. placebo; M/F 14/15 vs. 11/19; age 61.8 vs 57.7 Double blinded premedication with OM 90mg vs. placebo, given 90 mins prior to bronchoscopy. All patients - 4ml 4% lidocaine nebulised, lidocaine gel to nostril and 2ml 1% lidocaine as required to bronchial tree. Midazolam 1mg iv, titrated (not to set point). With placebo Next morning Vital signs, patient VAS - pain, cough, emotional reaction, complaints, expectation, fear, feeling of unpleasantness and stress level, level of communication, cooperation and level of information about procedure, Physician VAS - patient cooperation, communication, wakefulness, patient stress, patient cough, patient sputum. Volume of lidocaine significantly lower requirement for midazolam (3.1 vs. 4.2mg, p=0.01) and lidocaine (1.4 vs 4.3ml, p=0.00001) in DM group, DM vs. placebo - less pain (VAS 1.3 vs. 2.3, p=0.00005); lower anxiety levels postprocedure (VAS 4.7 vs. 7, p=0.00001); score of complaints (VAS 1.1 vs. 3.6, p=0.001); stress level during procedure (VAS 2.3 vs. 3.2, p=0.005); level of fear of procedure (VAS 2.4 vs. 3.3, p=0.0005); unsatisfactory of procedure (VAS 1.9 vs. 3.1, p=0.00005); cough (1.5 vs. 3.2, p=0.05). Physician assessment found patients to be more cooperative in DM arm, and patients in DM group were significantly less awake after procedure. Not stated Small study suggesting benefit for dextromethorphan as a premedication to reduce midazolam/lidocaine requirement while improving patient perception of cough, pain, fear and tolerance. Lack of detailed information about characteristics of population e.g. co-morbidities, and lack of sedation to a defined level means that conclusions are limited.

Silvestri, Gerard A, Vincent, Brad D, Wahli, Momen M, Robinette, Emory Fospropofol Bronchoscopy, James R. Downie, Gordon H.
A phase 3, compared, double-blind study to assess the efficacy and safety of fospropofol intravenous injection for moderate sedation in patients undergoing flexible bronchoscopy

2009 CHEST 41-7 RCT - 256 randomised to fospropofol 6.5mg/kg 103 randomised to fospropofol 2mg/kg Patients => 18 years old undergoing bronchoscopy by physicians without anaesthetic support, who did not have a predicted difficult airway (Malampatti IV or Mallampati III with thyromental distance <=4cm). Intravenous fospropofol randomised to either 6.5 or 2mg/kg (with routine intravenous fentanyl 50microg and topical lidocaine for both arms)

Comparison between two arms (fospropofol 6.5mg/kg or 2mg/kg)

Until ready for discharge post bronchoscopy

Primary - Modified Observer’s Assessment of Alertness/Sedation success (3 consecutive scores <= 4 after fospropofol). Secondary - Treatment success (Bronchoscopy completion without alternative sedation or mechanical ventilation), proportion willing to be retreated; proportion who did not recall being awake during bronchoscopy; patients requiring supplementary fentanyl; number of supplemental fospropofol doses; level of sedation; time to sedation; time to full alertness; safety

Primary outcome (6.5mg/kg vs. 2mg/kg). Sedation success rates were 18.7% and 27.5%, respectively (p < 0.0001). Secondary outcomes (6.5mg/kg vs. 2mg/kg); Treatment successes (91.3% vs 41.2%, respectively; p < 0.001), willingness to be treated again (94.6% vs 57.2%, respectively; p < 0.001), absence of procedural recall (83.3% vs 55.4%, respectively; p < 0.001). Median time to full alertness was slightly longer for the 6.5 mg/kg dose (5.5 vs 3.0 min, respectively). The proportion of patients requiring supplemental therapy with analgesics (16.7% vs 37.3%, respectively) and the use of alternative sedative medications (8.0% vs 58.8%, respectively) were lower for patients in the 6.5 mg/kg dose group (all comparisons, p < 0.001).

Industry grant Fospropofol, at a dose of 6.5mg/kg, may have a role as a sedative for bronchoscopy, although transient side effects (such as paraesthesia and pruritus) are common. Hypoaesthesia and hypotension are also seen. Further studies comparing fospropofol with commonly used agents are required.
BTS Guideline for diagnostic flexible bronchoscopy in Adults
Evidence Tables for Premedication, Sedation & Topical Anaesthesia

Stolz, D.; Chihaide, P. N.; Leuppi, J. D.; Brutsche, N.; Pfirrmann, E.; Strobel, W.
Tamm, M.
Cough suppression during flexible bronchoscopy using combined sedation with midazolam and hydrocodone: a randomised, double-blind, placebo-controlled trial

2004 THORAX 73:6 RCT ++ 120 patients, 60 in each arm.
120 consecutive patients undergoing diagnostic flexible bronchoscopy, with mean age 62 years, having a variety of BAL, brushing, endobronchial and transbronchial biopsies and TBNA.
Sedation and cough suppression during flexible bronchoscopy with either 5mg iv hydrocodone and titrated iv midazolam or placebo and titrated iv midazolam. Both groups received topical lidocaine (nebulised 4% and 4ml lidocaine, 4x sprays of 2% lidocaine to naopharynx, 3x sprays of 2% lidocaine in oropharynx, 3ml 1% lidocaine to vocal cords and spray-as-you-go aliquots of 3ml 1% lidocaine to tracheobronchial tree. All patients had supplemental nasal cannula oxygen at 8l/min (increased to 66l/min as required).
Between treatment (iv hydrocodeine) and placebo (iv saline).
Until 2 hours post-bronchoscopy
Physician and nurse assessment of cough (10cm VAS) and patient assessment of tolerability (10cm VAS) performed 2 hours post-bronchoscopy.
VAS-assessment of perception of cough by bronchoscopist and nurse assessment of lower cough in the hydrocodeine group (median 3 (range 0–10) and 3 (0–10)) than in the placebo group (6 (0–10) and 6 (0–10), respectively (p = 0.001). Patients’ VAS-assessment of tolerance (2 hours post-bronchoscopy) was also significantly better with hydrocodeine than with placebo (2 (0–8) v 3 (0–9), p = 0.043).
Not stated
Bromochoscopist and nurse perception of cough and patient assessment of bronchoscopy tolerability are significantly improved by addition of hydrocodeine (to midazolam) for flexible bronchoscopy

Stolz, D.; Chihaide, P. N.; Leuppi, J. D.; Pfirrmann, E.; Strobel, W.
Tamm, M.
Propofol versus fentanyl in flexible bronchoscopy: a randomised non-inferiority trial

2009 EUROPEAN RESPIRATORY JOURNAL 30:4-5 RCT ++ 200, 100 randomised to each arm.
Consecutive patients attending for diagnostic bronchoscopy, 33% for infection, 35% for malignancy.
Sedation with either 5mg iv hydrocodeine + titrated iv midazolam vs titrated iv propofol.
Between treatment comparison.
Until leaving bronchoscopy: recovery area.
Primary - mean lowest arterial oxygen saturation and patient-assessed VAS of readiness-for-discharge (although this is not what stated in BRC1997542441). Secondary - haemodynamic parameters, procedural complications, patient cough, fear and discomfort VAS assessment.
Non-inferiority of propofol for mean lowest arterial oxygen saturation and readiness-for-discharge at 1 hour (with possible suggestion of benefit). Non-inferiority for haemodynamic parameters and procedural complications.
Not stated
Propofol is not associated with increasing episodes of desaturation compared with midazolam and hydrocodeine. Possible earlier readiness-for-discharge with propofol, but this is patient reported and needs validation, particularly with reference to physician/nursing concordance.

Visco, D.; Chhiagio, PN; Leuppi, J. D.; Pfirrmann, E.; Strobel, W.
Tamm, M.
Nebulised lidocaine for flexible bronchoscopy: a randomized, double-blind, placebo-controlled trial

2005 CHEST 127:6-70 RCT ++ 150 consecutive patients, 75 in each arm.
Tertiary care university hospital; 150 patients (93 men, age 20-89 years); excluded intubated patients and those receiving propofol and patients requiring EBUS.
4 ml of 4% lidocaine (160 mg) or 4 ml of saline solution as placebo via nebulisation over 15mins immediately before bronchoscopy. All received nasal 10% lidocaine sprays x4 and oropharyngeal nebulised lidocaine x2. Lidocaine administered via bronchoscope was measured, and as a minimum was usually, 3ml 1% lidocaine to cords, trachea and right and left main bronchi. All received combined sedation with 5mg iv hydrocodone, 2mg midazolam with 1-2mg intermittent boluses as required. Bronchoscopy was performed transanally with supplemental oxygen at 4-4.5l/min via nasal cannulae.
Treatment vs. placebo.
Until 2-3 hours post bronchoscopy
Primary outcome was supplemental lidocaine doses (lidocaine only) (paired t test). Secondary outcomes - Bronchoscopic procedures immediately post bronchoscopy and patients (2-3 hours post bronchoscopy) charted their perception of cough on a 10cm visual analogue scale (VAS). Patients also recorded their discomfort related to the procedure on a 10cm VAS.
Primary outcome (supplemental lidocaine dose) was the same (158mg vs. 157mg lidocaine (intervention vs. placebo). There were no significant differences in cough VAS score (patient and physician assessment) and discomfort VAS score (patient assessment). The average midazolam dose was 5mg vs. 4.9mg. Total lidocaine dose (including nebulisation) of 318mg vs. 157mg (treatment vs. placebo), p<0.001
Not stated
Nebulised 4% lidocaine does not decrease the requirement for spray-as-you-go topical lidocaine, and does not improve physician cough VAS assessment or patient 2-3 hour cough or discomfort VAS assessment.

Veisso, D.; Chihaide, P. N.; Orehek, J.
Attenuation of bronchoscopic spray-induced cough by an inhaled 4% lidocaine inhaler, 6% lido
dener
1988 American Review of Respiratory Disease 80:5-6 RCT ++ 40 patients; 20 to placebo arm, 20 to fenten
or
Placbo vs. fenten
or
4 mg of 4% lidocaine (160 mg) or 4 ml of saline solution as placebo via nebulisation over 15mins immediately before bronchoscopy. All received nasal 10% lidocaine sprays x4 and oropharyngeal nebulised lidocaine x2. Lidocaine administered via bronchoscope was measured, and as a minimum was usually, 3ml 1% lidocaine to cords, trachea and right and left main bronchi. All received combined sedation with 5mg iv hydrocodone, 2mg midazolam with 1-2mg intermittent boluses as required. Bronchoscopy was performed transanally with supplemental oxygen at 4-4.5l/min via nasal cannulae.
With placebo.
First 5 mins of bronchoscopy
Number of coughs for 5 mins each of bronchoscopy through cords.
Significantly lower cough rate for patients receiving fentanyl vs. placebo (~35 vs. ~55, p<0.01 - data interpreted from graph). More patients receiving fentanyl did not receive additional lidocaine (10 vs. 3, p<0.02). Smokers coughed more than non smokers (48 vs. 33, 6, p<0.01).
In a small randomised study, fentanyl was associated with a significantly reduced cough rate and need for additional lidocaine, although characteristics of asthma, COPD and FEV1/FVC not given > overall conclusions limited.

Local anaesthesia for fiberoptic bronchoscopic transbronchial biopsy or bronchoscopic aspiration via the spray-as-you-go technique

1990 THORAX 45:47 RCT + 35 patients in each group (cricotidostomy vs. spray-as-you-go).
Patients undergoing diagnostic bronchoscopy (not for haemoptysis with a normal chest radiograph, abnormal chest CT, or stridor). Spray vs. cricotidostomy - 18 vs. 23 males; age 62 ± 5; 62.2%: 100.17microg/kg vs 10.44microg/kg.
Patients undergoing diagnostic bronchoscopy (not for haemoptysis with a normal chest radiograph, abnormal chest CT, or stridor). Spray vs. cricotidostomy - 18 vs. 23 males; age 62 ± 5; 62.2%: 100.17microg/kg vs 10.44microg/kg.
Between treatment.
Between treatment from bronchoscopy recovery.
Faster to cross vocal cords for cricotidostomy - 1.35mins vs. 2.69mins (p<0.01). Time to complete bronchoscopy similar. More patients in cricotidostomy group required further local anaesthesia (15 vs. 8, p<0.05) although these doses lower for cricotidostomy (332mg vs. 451mg p<0.001). Cough rate lower in cricotidostomy group (5.56 v 8.62). No significant differences between patient tolerance VAS. Small amounts of blood in trachea in 23/30, not interfering with bronchoscopy. 17/30 found cricotidostomy ‘not unpleasant’.
Cricotidostomy anaesthesia is associated with a lower cough rate once bronchoscope has been passed through vocal cords. Clinical bronchoscopic passage of vocal cords is faster with cricotidostomy, but this doesn’t include consideration of total procedure time, including cricotidostomy. Cricotidostomy associated with lower total dose of lidocaine, although 4% lidocaine used for vocal cords in ‘spray arm’. No significant differences between patient tolerance VAS. Small amounts of blood in trachea in 23/30, not interfering with bronchoscopy.
Williams, T.; Brooks, T.; Ward, C.; The role of atropine premedication in fiberoptic bronchoscopy using intravenous midazolam sedation; CHEST 1998; 114:4-8; RCT++


Zainudin, B. M.; Rafia, M. H.; Sufian, A. W.; Topical nasal anaesthesia for fiberoptic bronchoscopy: lignocaine spray or gel? SINGAPORE MEDICAL JOURNAL 1993; 24:9-14; RCT++


BTS Guideline for diagnostic flexible bronchoscopy in Adults
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**Xue, Fu; Su, L.; Hu, H.; Nong, X.; Xu, Y.; Fang, Z.; Guo, X.; Yuan, M.**

Spray-as-you-go airway topical anaesthesia in patients with a difficult airway: a randomised, double-blind comparison of 2% and 4% lidocaine; *ANESTHESIA & ANALGESIA* 2009; 108:43-53; RCT++

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Topical nasal anaesthesia for fiberoptic bronchoscopy: lignocaine spray or gel? *SINGAPORE MEDICAL JOURNAL* 1993; 24:9-14; RCT++

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**Guo, Xin L.; Liao, Xu; Yang, Quan Y.; Liu, He P.; Grigg, J. A.; Webb, A. R.**

Topical nasal anaesthesia for fiberoptic bronchoscopy: fibreoptic anaesthesia for patients' preference for lignocaine gel; *THORAX* 1989; 44:57-60; RCT++

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