

## APPENDIX 8: DRUGS USED IN BRONCHOSCOPY.

All tables are for guidance only; for up to date information on doses, side effects and interactions, refer to the British National Formulary.

Table 1 Commonly used drugs in bronchoscopy

Drug	Dose	Speed of Onset / Duration of Action / Half-life	Common / Serious Side Effects	Comments
<b>Midazolam</b>	<p>Slow IV injection - maximum rate 2 mg/min</p> <ul style="list-style-type: none"> <li>▶ Initial dose: 2 mg-2.5 mg (0.5-1 mg in the frail or elderly) given 5-10 mins before procedure</li> <li>▶ Supplemental doses, if required: 1 mg (0.5-1 mg in frail or elderly), at 2-10 mins intervals</li> <li>▶ Usual maximum total dose: 3.5-7 mg (3.5 mg in frail or elderly) for standard bronchoscopic procedures. May be higher in longer procedures (e.g. EBUS)</li> </ul>	<p>Onset of Sedation</p> <ul style="list-style-type: none"> <li>▶ Within 2 mins, with maximum effect at 5-10 mins. (May be longer in frail or elderly or those with chronic illnesses)</li> </ul> <p>Duration of Action</p> <ul style="list-style-type: none"> <li>▶ Variable, but typical range is 30-120 mins</li> </ul> <p>Approximate half-life</p> <ul style="list-style-type: none"> <li>▶ 1.5-2.5 hours</li> </ul>	<p>Respiratory depression, apnoea, bronchospasm, laryngospasm, hypotension, heart rate alterations, cardiac arrest.</p> <p>Life-threatening side effects and prolonged sedation are more likely in the elderly and those with impaired respiratory or cardiovascular status, hepatic impairment, renal impairment, myasthenia gravis, and with rapid IV injection.</p>	<p>Enhanced sedation and increased risk of respiratory depression when combined with opioids. When combined sedation is used, opioids should always be administered prior to midazolam.</p> <p>To prevent risk of accidental overdose, only 1 mg/mL vials should be available in bronchoscopy suites. 2 mg/mL or 5 mg/mL vials should not be available unless a formal risk assessment has been undertaken.</p>
<b>Fentanyl</b>	<p>Slow IV injection - usually over 1-3 mins</p> <ul style="list-style-type: none"> <li>▶ Initial dose: 25 micrograms</li> <li>▶ Supplemental doses, if required: 25 micrograms</li> <li>▶ Usual maximum total dose: 50 micrograms</li> </ul>	<p>Onset of Sedation</p> <ul style="list-style-type: none"> <li>▶ Almost immediate, with maximum effect at 5 mins</li> </ul> <p>Duration of Action</p> <ul style="list-style-type: none"> <li>▶ Variable, but typical range is 30-60 mins</li> </ul> <p>Approximate half-life</p> <ul style="list-style-type: none"> <li>▶ 2-7 hours</li> </ul>	<p>Nausea, vomiting and other GI upset, myoclonic movements, hypo/hypertension, arrhythmia, cardiac arrest. Caution in elderly patients and those with impaired respiratory or cardiovascular status, hepatic impairment and myasthenia gravis.</p>	<p>Enhanced sedation and respiratory depression when given with benzodiazepines. When combined sedation is used, opioids should always be administered prior to midazolam.</p>
<b>Alfentanil</b>	<p>Slow IV injection - usually over 30 secs</p> <ul style="list-style-type: none"> <li>▶ Initial dose: 250 micrograms</li> <li>▶ Supplemental doses, if required: 250 micrograms</li> <li>▶ Usual maximum total dose: 500 micrograms</li> </ul>	<p>Onset of Sedation</p> <ul style="list-style-type: none"> <li>▶ Almost immediate onset and maximum effect</li> </ul> <p>Duration of Action</p> <ul style="list-style-type: none"> <li>▶ Variable, but usually shorter than fentanyl</li> </ul> <p>Approximate half-life</p> <ul style="list-style-type: none"> <li>▶ 1-2 hours</li> </ul>	<p>See Fentanyl</p>	<p>See Fentanyl</p>
<b>Lidocaine</b>	<p>Intranasal</p> <ul style="list-style-type: none"> <li>▶ Lidocaine 2% gel: 6 mL (120 mg)</li> </ul> <p>Oropharynx</p> <ul style="list-style-type: none"> <li>▶ Lidocaine 10% spray: 3 actuations (30 mg)</li> </ul> <p>Vocal cords, tracheobronchial tree</p> <ul style="list-style-type: none"> <li>▶ Lidocaine 1% solution: 2 mL boluses applied topically, as required</li> </ul> <p>Maximum total dose (see Table 3)</p> <ul style="list-style-type: none"> <li>▶ Use minimum dose to achieve effective cough suppression and patient comfort. Subjective symptoms of Lidocaine toxicity are common when &gt;9.6 mg/kg is used; much lower doses are usually sufficient.</li> </ul>	<p>Onset of Action</p> <ul style="list-style-type: none"> <li>▶ 3 to 5 mins</li> </ul> <p>Duration of Action</p> <ul style="list-style-type: none"> <li>▶ Variable, but typical range is 60-90 mins</li> </ul> <p>Approximate half-life</p> <ul style="list-style-type: none"> <li>▶ 1.5-2 hours</li> </ul>	<p>CNS effects (confusion, blurred vision, dizziness, drowsiness, lightheadedness, myoclonus, nausea, nystagmus, paraesthesia, restlessness, tremulousness, coma, convulsions, respiratory failure)</p> <p>CVS effects (hypotension, bradycardia, arrhythmia, cardiac arrest).</p> <p>Methaemoglobinaemia (rare).</p> <p>Caution in those with hepatic and cardiac dysfunction, and with significant renal impairment.</p>	
<b>Adrenaline</b>	<p>Topical</p> <ul style="list-style-type: none"> <li>▶ Adrenaline 1:10,000: 2 to 10 mL</li> </ul>		<p>Hypertension, tachycardia, arrhythmia, tremor.</p>	

Adapted from 'Drugs in Bronchoscopy' (BTS Bronchoscopy eLearning Module available at: <http://learninghub.brit-thoracic.org.uk/?bts=topic&param=3>), with kind permission of Toby Capstick and Daniel G Peckham.

**Table 2** Antagonists available for sedative drugs used in bronchoscopy

Drug	Dose	Speed of Onset / Duration of Action / Half-life	Common / Serious Side Effects	Comments
<b>Flumazenil</b>	<b>To reverse midazolam</b> ▶ Initial dose: 200 micrograms IV over 15 secs ▶ Supplemental doses: 100 micrograms every 60 secs if inadequate response ▶ Typical cumulative dose range: 300-600 micrograms ▶ Maximum total dose: 1 mg	Onset of Action ▶ 1 min Duration of Action ▶ 1-4 hours Approximate half-life ▶ 40-80 mins	Nausea, vomiting, anxiety, agitation, dizziness, hypertension, tachycardia. May lower seizure threshold. May cause withdrawal in chronic benzodiazepine users.	Flumazenil has a shorter duration of action than midazolam, and so patients should be observed long enough to ensure that sedation and cardiorespiratory depression does not recur once the effect of flumazenil ceases. Further doses may be required. Where combined sedation with midazolam and opioid has been used, it is recommended that flumazenil is administered first, unless a large dose of opioid has been given
<b>Naloxone</b>	<b>To reverse opioids</b> ▶ Initial dose: 100-200 micrograms IV ▶ Supplemental dose: 100 micrograms every 2 mins if inadequate response	Onset of Action ▶ 2-3 mins Duration of Action ▶ 45 mins to 4 hours Approximate half-life ▶ 1-1.5 hours	Nausea, vomiting, dizziness, headache, tachycardia, hypo/hypertension. May cause withdrawal in chronic opioid users.	Naloxone has a shorter duration of action than many opioids, and so patients should be observed long enough to ensure that sedation and cardiorespiratory depression does not recur once its effect ceases. Further doses may be required.

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**Table 3** Doses and concentrations of lidocaine used for bronchoscopy

Drug	Dose per unit volume	Site of application	Comments
Lidocaine 2% gel	20 mg/mL	Nasal	Gel preparation syringe typically contains 6 mL (120 mg)
Lidocaine 10% aerosol spray	10 mg/actuation	Oropharynx	3 actuations (30 mg) often sufficient
Lidocaine 1% solution	10 mg/mL	Vocal cords, trachea and bronchial tree	

## APPENDIX 9 SEDATION SCORING SCALES WHICH MAY BE USED TO AID ASSESSMENT AND DOCUMENTATION OF SEDATION LEVEL

### Ramsay Scale (RS)

Level	Response
1	Anxious and agitated or restless
2	Cooperative, orientated and tranquil
3	Responds only to commands
4	Brisk response to light glabellar touch or loud noise
5	Sluggish response to light glabellar touch or loud noise
6	No response to light glabellar touch or loud noise

Ramsay MA, Savege TM, Simpson BR, Goodwin R. Controlled sedation with alphaxalone-alphadolone. *Br Med J.* 1974 Jun. 22;2(5920):656-9.

### Modified Observer's Assessment of Alertness/Sedation (MOAAS) scale

Level	Response
5	Responds readily to name spoken in normal tone
4	Lethargic response to name spoken in normal tone
3	Responds only after name is called loudly or repeatedly
2	Responds only after mild prodding or shaking
1	Does not respond to mild prodding or shaking
0	Does not respond to pain

Chernik DA, Gillings D, Laine H, Hendler J, Silver JM, Davidson AB, et al. Validity and reliability of the Observer's Assessment of Alertness/Sedation Scale: study with intravenous midazolam. *J Clin Psychopharmacol.* 1990 Aug.;10(4):244-51.