Appendix G: Asthma Medications (Updated 2008)

The list of asthma medications published in the original *Promoting Asthma Control in Children* (2004) guideline was reviewed in November 2007 to reflect current medication options and/or availability in Canada. The following table replaces the one found in the original guideline (pp. 93-97).

Relievers

Medications	Actions	Side Effects	Pharmacokinetics
Short acting ß$_2$-agonists:			
salbutamol • Airomir® MDI (HFA) 100µg • Apo-Salvent® MDI (HFA) 100µg • Novo-salmol® MDI (HFA) 100µg • Ventolin® Diskus® PD 200µg • Ventolin® MDI (HFA) 100µg • Ventolin® Nebules® Wet Nebulization 0.5mg/ml, 1.0mg/ml, or 2.5mg/ml terbutaline • Bricanyl® Turbuhaler® PD 500µg fenoterol • Berotec® vials Wet Nebulization 0.25mg/ml, 0.625g/ml	• Promotes bronchodilation through stimulation of ß$_2$-adrenergic receptors thereby relaxing airway smooth muscle **Onset of action:** a few minutes **Peaks:** 15-20 minutes **Duration:** 2-4 hours fenoterol up to 8 hours	• tremor • tachycardia • headache • nervousness • palpitations • insomnia	salbutamol **Absorption:** 20% inhaled, well absorbed (PO) **Distribution:** 30% inhaled, crosses blood-brain barrier, crosses placenta **Metabolism:** liver extensively, tissues **Excretion:** mostly urine, feces, breast milk **Half-Life:** 4-6 hrs terbutaline **Absorption:** partially absorbed (PO), minimal (inhalation) **Distribution:** crosses placenta **Metabolism:** liver, gut wall **Excretion:** bile, feces, urine, breast milk **Half-Life:** unknown fenoterol **Absorption:** minimal (inhalation), incomplete (PO) **Distribution:** unknown **Metabolism:** liver, 90% **Excretion:** breast milk, kidney 12% **Half-Life:** 7 hours
Anticholinergic:			
ipratropium bromide • Atrovent® MDI (HFA) 20µg • Atrovent® Wet Nebulization 125µg/ml and 250µg/ml	• An anticholinergic drug that has been shown to have bronchodilator properties • Reduces vagal tone to the airways **Onset of action:** 5-15 minutes **Peaks:** 1-2 hours **Duration:** 4-5 hours	• dry mouth • bad taste • tremor	ipratropium bromide **Absorption:** minimal **Distribution:** does not cross blood-brain barrier **Metabolism:** liver, minimal **Excretion:** urine, feces **Half-Life:** 3-5 hrs
Methylxanthine:			
aminophylline • Phyllocontin® SRT theophylline • Apo-Theo-LA SRT® • Novo-Theophyl SRT® • Quibron-T® • Theochron SRT® • Theolair SRT® 24-Hour: theophylline • Uniphyl®	• relaxes airway smooth muscle • may have some anti-inflammatory effect • clients may benefit even when serum levels are low	Are usually caused by a high serum concentration of the drug or the client's inability to tolerate the drug and include: • upset stomach with heartburn • nausea • diarrhea • loss of appetite • headache • nervousness • insomnia • tachycardia • seizures	theophylline **Absorption:** well absorbed (PO), slowly absorbed (extended release) **Distribution:** crosses placenta, widely distributed **Metabolism:** liver **Excretion:** kidneys, breast milk **Half-Life:** 3-13 hrs, increased in liver disease, CHF and elderly; decreased in smokers **Several drug interactions include:** • antibiotics • birth control pills

Controllers

Medications	Actions	Side Effects	Pharmacokinetics
Glucocorticosteroids (inhaled):			
beclomethasone • Alti-beclomethasone® MDI 50µg • QVAR® MDI(HFA) 50µg, 100µg budesonide • Pulmicort® Nebuamp® Wet Nebulization 0.125mg/ml, 0.25mg/ml and 0.5mg/ml • Pulmicort® Turbuhaler® PD 100µg, 200µg, and 400µg fluticasone • Flovent® Diskus® PD 50µg, 100µg, 250µg, and 500µg • Flovent® MDI(HFA) 50µg, 125µg, and 250µg	• Prevents and suppresses activation and migration of inflammatory cells • Reduces airway swelling, mucus production, and microvascular leakage • Increases responsiveness of smooth muscle beta receptors	Inhaled route (up to equivalent of 1000 µg/ day beclomethasone): • sore throat • hoarse voice • thrush • cough Rinsing, gargling and expectorating after inhalation can minimize these side effects. A spacer should be used with MDIs to reduce side effects.	beclomethasone **Absorption:** 20% **Distribution:** 10-25% in airways (no spacer) **Metabolism:** minimal **Excretion:** less than 10% in urine/feces **Half-Life:** 15 hrs budesonide **Absorption:** 39% **Distribution:** 10-25% in airways (no spacer) **Metabolism:** liver **Excretion:** 60% urine, smaller amounts in feces **Half-Life:** 2-3 hrs fluticasone **Absorption:** 30% aerosol, 13.5% powder **Distribution:** 10-25% in airways (no spacer), 91% protein binding **Metabolism:** liver **Excretion:** less than 5% in urine, 97-100% in feces **Half-Life:** 14 hrs
Glucocorticosteroids (oral/intravenous):			
ORAL prednisone • Prednisone 5mg and 50 mg tablets • Deltasone® 5mg and 50mg tablets prednisolone • Pediapred®1mg/ml liquid methylprednisolone • Medrol® 4mg tablets dexamethasone • Decadron® 0.5mg, 4mg tablets **INTRAVENOUS** • methylprednisolone • SoluCortef® • SoluMedrol®		**Oral or IV route – short term (less than 2 weeks):** • weight gain • increased appetite • menstrual irregularities • mood changes • muscle cramps • mild reversible acne • hyperglycemia (IV) **Oral route – long term (more than 2 weeks):** • adrenal suppression • immuno-suppression • osteoporosis • hyperglycemia • hypertension • weight gain • cataracts • glaucoma • peptic ulcer • ecchymosis • avascular necrosis of the hip	prednisone **Absorption:** well absorbed **Distribution:** widely distributed; crosses placenta **Metabolism:** liver, extensively **Excretion:** kidney, breast milk **Half-Life:** 3-4 hrs IV steroids **Absorption:** rapid **Distribution:** widely distributed **Metabolism:** liver **Excretion:** kidneys **Half-Life:** 18 - 36 hrs, depending on the drug
Long-Acting ß$_2$-agonists:			
formoterol • Foradil® PD 12µg • Oxeze® Turbuhaler® PD 6µg and 12µg salmeterol • Serevent® Diskus® PD 50µg • Serevent® Diskhaler® PD 50µg	• Promotes bronchodilation through stimulation of ß$_2$-adrenergic receptors thereby relaxing airway smooth muscle formoterol **Onset of action:** 1-3 minutes **Duration:** 12 hours salmeterol **Onset of action:** 10-20 minutes **Duration:** 12 hours	• tremor • tachycardia • headache • nervousness • palpitations • insomnia	formoterol **Absorption:** rapid, lung deposition 21-37% **Distribution:** plasma protein binding approximately 50% **Metabolism:** liver, extensive **Excretion:** 10% unchanged in urine **Half-Life:** approximately 8-10 hours salmeterol **Absorption:** minimal systemic **Distribution:** local **Metabolism:** liver first pass **Excretion:** unknown **Half-Life:** 5.5 hrs

Medications	Actions	Side Effects	Pharmacokinetics
Anti-Leukotrienes:			
montelukast • Singulair® 4mg, 5mg and 10mg tablets • Singulair® 4mg oral granules zafirlukast • Accolate® 20mg tablets	• Blocks the action of leukotrienes that are released by the membranes of inflammatory cells in the airways • Note: Bioavailability is reduced with Accolate® when given with food	montelukast • headache • abdominal pain zafirlukast • headache • indigestion • stomach upset	montelukast **Absorption:** rapidly **Distribution:** protein binding 99% **Metabolism:** liver **Excretion:** bile **Half-Life:** 2.7-5.5 hrs zafirlukast **Absorption:** rapid after oral administration **Distribution:** enters breast milk, 99% protein binding **Metabolism:** liver **Excretion:** feces, breast milk, 10% unchanged by kidneys **Half-Life:** 10 hrs
Non-steroidal (anti-allergic) Anti-inflammatory:			
sodium cromoglycate • Intal Ampules® Wet Nebulization 2ml:10mg/ml	• Inhibits the mediator release from mast cells	• throat irritation • cough	**Absorption:** poorly **Distribution:** unknown **Metabolism:** unknown **Excretion:** unchanged mostly in feces, bile and urine **Half-Life:** 80 min
Anti – Immunoglobulin E (IgE) Neutralizing Monoclonal Antibody (Anti – IgE):			
omalizumab • Xolair® Subcutaneous 150mg – 375mg S.C. Q2 – 4 weeks. - *Indicated for adolescents, aged ≥12, and adults*	• Binds to IgE preventing binding of IgE to the high affinity FceRI receptor, thereby reducing the amount of free IgE that is available to trigger the allergic-cascade. • This medication prevents free serum IgE from attaching to mast cells and prevents IgE mediated inflammatory changes.	• Anaphylaxis • Malignancy • Immunogenicity • Injection site irritation • Viral infections • Upper respiratory tract infections • Sinusitis • Headache • Sore throat	**Absorption:** Average absolute bioavailability of 62%. **Distribution:** Peak serum concentrations after an average of 7 – 8 days. **Metabolism:** Liver **Excretion:** Involved with IgG clearance via liver – bile and in breast milk. **Half–Life:** 26 days.
Anticholinergic:			
ciclesonide • Alvesco® MDI (HFA) 100µg and 200µg - *Indicated for adolescents, aged ≥12, and adults*	• Once inhaled, it is converted in the lungs to its active metabolite, which is a potent glucocorticoid that binds to glucocorticoid receptors in the lung resulting in local pronounced anti-inflammatory activity.	• Paradoxical bronchospasm	**Absorption:** The systemic bioavailability for the active metabolite is >50% by using the ciclesonide MDI. **Distribution:** High protein binding, approximately 1% is available for systemic exposure. **Metabolism:** Hydrolysed to its pharmacologically active metabolite by esterase enzymes primarily in the lungs. **Excretion:** Liver – bile **Half-Life:** Approximately 6 hours.
Combination Drugs:			
Long-acting bronchodilators and inhaled steroids budesonide and formoterol • Symbicort® Turbuhaler® PD 100/6µg, 200/6µg fluticasone and salmeterol • Advair® Diskus® PD 100/50µg, 250/50µg, 500/50µg • Advair® MDI(HFA) 125/25µg, 250/25µg	• the same as those listed for each medication separately		

Legend:
HFA – hydrofluoralkane
MDI – metered dose inhaler
PD – powder device
SRT – sustained release tablet