### Salbutamol

This poster presentation will show the pharmacodynamics and pharmacokinetics of Salbutamol. It will then explain the potential effects Salbutamol has on the body as well as showing how disease effects Salbutamol therapy. Funding and authorisation of Salbutamol will be described. The use of Salbutamol in my clinical practice will be discussed and recommendations will be made for colleagues around administration and monitoring of this drug.

Salbutamol is a common drug for asthma relief Mann (2000). Therefore poster presentation focuses on the role of Salbutamol in the relief of Asthma.

### Asthma

Dunn et al. (2000) define Asthma as:

- Bronchial Smooth Muscle Constriction.
- Mucous Hyper-secretion (Mucus Plugs) in the Bronchi.
- Inflammation of Bronchial wall.

![Figure 1: Bronchi during Asthma - Dr.Paul Communications Inc (2003)](image-url)
Pharmacokinetics

Salbutamol is available for administration by the following routes: Inhalation, tablet, elixir, intravenous injection, subcutaneous injection, intramuscular injection. Spina et al. (1997) has completed animal testing on sub-lingual Salbutamol but it is not available in New Zealand.

Absorption

Figure 2: Compiled from information gathered from the following sources - Pacific Pharmaceuticals Limited (2003), Apotex NZ Ltd (2003), Katzung (1998), GlaxoSmithKline NZ Limited (2003c), PHARMAC (2003), Galbraith et al. (1994)
**Distribution**
Salbutamol binds to and releases from plasma proteins as necessary.

![Salbutamol binds to a plasma protein - Galbraith et al. (1994), Katzung (1998)](image)

**Metabolism**
Salbutamol absorbed in the gastrointestinal tract has a substantial first pass and is metabolised into Phenolic Sulfate.

![Salbutamol Metabolism - GlaxoSmithKline NZ Limited (2003c)](image)

Inhaled Salbutamol acts directly on smooth muscle of the upper airways bypassing metabolism in the liver.

**Excretion**
Salbutamol and Phenolic Sulfate are primarily excreted via the urinary system.

![Excretion - Rang et al. (1999), Galbraith et al. (1994)](image)
Summary of Pharmacokinetics

Figure 6: Adapted from Adrenergic Agonist Effects - Galbraith et al. (1994), Rang et al. (1999)
Pharmacodynamics

Figure 7: Pharmacodynamics of Salbutamol - Galbraith et al. (1994), Dunn et al. (2000)
Salbutamol is a selective $\beta_2$ agonist which primarily binds to $\beta_2$ receptors at the synapse with very little binding to $\beta_1$ receptors.

Non selective medication, such as Adrenalin binds to $\beta_1$ and $\beta_2$ receptors. Salbutamol has an advantage in asthma treatment by minimising side effects associated $\beta_1$ receptor stimulation which Adrenalin causes Mann (2000).

![Diagram](image)

**Figure 8: Direct Acting Agonist Action - Galbraith et al. (1994)**
Potential Drug Interactions

Contraindications / Warnings

- Hypersensitivity to ingredients of Salbutamol
- Chlorofluorocarbon propellants used in some aerosol inhalers can produce cardiac arrhythmias and sensitise the heart to adrenalin induced arrhythmias.
- Dunn et al. (2000) aerosol inhalers can affected by decreased temperature which increases particle size of drug making absorption more difficult.
- Salbutamol may cause fetal congenital abnormalities when used in pregnancy and its effects on a neonate when breast feeding are unknown.
Effects of Salbutamol on Body Systems

Effects of Disease on Salbutamol Therapy

Hyperthyroidism
- Salbutamol with hyperthyroidism causes increase metabolism. Also many patients with hyperthyroidism take beta-blockers which can counteract the effect of salbutamol.

Cardiovascular Disease
- ECG Changes

Diabetes
- Salbutamol can cause Metabolic changes such as increased blood sugar can cause diabetic patients to be unable to compensate leading to ketoacidosis.

Renal Impairment
- 50% of metabolised salbutamol (metabolites) are excreted via the renal system. Renal impairment may mean that doses of salbutamol need to be altered for this group of patients.

Figure 11: Adapted from Galbraith et al. (1994), Douglas Pharmaceuticals Ltd (2003)
Authorisation of Salbutamol

Salbutamol is a prescription medication and must be prescribed by a Medical Doctor.

An exception according to GlaxoSmithKline NZ Limited (2003a) is Ventolin Elixir which is a Restricted or Pharmacist Only Medication.

Figure 12: Classification of Medications - MEDSAFE (2003)
Funding

Pharmaceutical Management Agency of New Zealand (PHARMAC) manage a Pharmaceutical Schedule on behalf of the Ministry of Health in New Zealand. This Schedule governs subsidisation to Pharmaceutical Manufacturers for that drug.

New Zealand Pharmaceutical Manufacturers apply to have their drug listed on the Pharmaceutical Schedule. This decreases the cost of manufacture and in turn the cost of the drug to the public.
Pharmaceutical Schedule Listing for Salbutamol

Figure 14: Salbutamol on the Pharmaceutical Schedule from PHARMAC (2003).
Clinical Practice Situation
Drug Administration by Nurses

An aid to correct administration of Salbutamol suggested by Galbraith et al. (1994) is the 5 Rights of Drug Administration.

- Right Patient
- Right Drug
- Right Time
- Right Dose
- Right Route

Figure 16: 5 Rights of Drug Administration - Galbraith et al. (1994)
Standing Order

In my clinical situation a standing order for nebulised Salbutamol 5mg and Combivent 20mcg exists.

This applies to any patient who presents to the practice nurse and meets all of the following criteria:

- Audible expiratory wheeze
- Shortness of breath
- Unable to complete full sentences
- Regular patient at this practice
- Diagnosed with Asthma
- Prior prescription and administration of Salbutamol 5mg and Combivent 20mcg in this practice

The patient must be assessed by the GP as soon as possible during or after the above drug therapy.

This standing order appears to agree with the Asthma and Respiratory Society of New Zealand best practice guidelines in treating acute asthma (as shown in the diagram opposite).

Critical Analysis

This standing order and 5 rights of drug administration do not include informed consent, preparation of the client or documentation after administration which I feel are integral in correct drug administration. It could be argued that presenting for treatment is consent. In that case I question whether it is truly informed?

Pacific Pharmaceuticals Limited (2003) say that some patients receive an decreased and therefore ineffective dose of Salbutamol due to poor coordination and inhaler technique. This shows a need for patient education and alternative methods of administration such as a spacer.

A similar issue around dose effectiveness is the venting of aerosol and nebuliser into the air. This begs the question - how are we able to measure the dose our patient receives? From this a need for checking equipment knowledge, dexterity, administration technique for both nurse and patient are apparent.
Figure 17: Management of Acute Asthma - The Asthma and Respiratory Foundation of New Zealand (2003).
Recommendations to Colleagues

Administration

- Have a good knowledge of your patient and their history (including allergies) and relate this to the drug being administered.
- Ensure that Salbutamol is prescribed correctly or you have a clear standing order.
- Have good knowledge of the equipment to administer Salbutamol.
- Ensure informed consent from the patient for giving Salbutamol.
- Use the 5 rights to ensure correct Salbutamol administration.
- Document the Salbutamol administration.

Monitoring

- Monitor stock levels - ensure that there is adequate supply and that it is all accounted for.
- Ensure Salbutamol is stored in conditions required by the manufacturer. Be aware that environmental temperature may alter particle size and therefore absorption of inhaled Salbutamol.
- Maintain a knowledge of your client and how their Asthma drug regime is working.
- Hold regular workshops for clients to learn about correct inhaler technique, spacers or other aids in Salbutamol administration. Use these sessions to monitor their technique and management of their asthma.

Conclusion

This poster presentation has described the pharmacodynamics and pharmacokinetics of Salbutamol and shown its potential effects on body systems. Authorisation for use and funding have been discussed as well as recommendations for administration and monitoring in clinical practice using best practice guidelines.
References


