

# Summary of Product Characteristics

## 1 NAME OF THE MEDICINAL PRODUCT

Pulmicort Turbohaler 400 micrograms Inhalation Powder

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each metered dose contains budesonide, 400 micrograms.

For the full list of excipients, see section 6.1.

## 3 PHARMACEUTICAL FORM

Inhalation Powder.

Breath actuated metered dose inhaler. White to off-white spherical granules which break into a fine powder on inhalation.

## 4 CLINICAL PARTICULARS

### 4.1 Therapeutic Indications

Pulmicort is recommended in patients with bronchial asthma.

Pulmicort is indicated for the treatment of chronic obstructive pulmonary disease (COPD). Treatment should be maintained where a beneficial response is obtained during the first 3 - 6 months of therapy.

### 4.2 Posology and method of administration

#### Posology

#### **COPD**

Adults (including the elderly): The recommended dose is 400 micrograms twice a day.

#### **Bronchial asthma**

When starting treatment, or during periods of severe asthma and whilst reducing or discontinuing the dosages of oral corticosteroids, the dosage should be adjusted to the individual needs of the patient.

Adults: Recommended dosage: 200 - 1600 micrograms daily.

In mild to moderate asthma, a dose of 200 - 800 micrograms daily, in single or divided doses, may be used. In severe asthma, the daily dosage may be increased to a maximum of 1600 micrograms, in divided doses.

Children 5 years of age and above (as children under 5 years may not be able to handle the device properly):

Recommended dosage 200 - 800 micrograms daily, in single or divided doses. In severe asthma, the daily dosage may be increased to a maximum of 800 micrograms, in divided doses.

The elderly: Dosage as for adults.

The maintenance dose should be the lowest possible. Administration once or twice daily (morning and evening) is usually sufficient.

In patients where an increased therapeutic effect is desired, an increased dose of Pulmicort is recommended, because of the lower risk of systemic effects as compared with a combined treatment with oral corticosteroids.

**Onset of effect**

Improvement in asthma control following inhaled administration of Pulmicort Turbohaler can occur within 24 hours of initiation of treatment, although peak effect may not be achieved for 1 to 2 weeks or longer after starting treatment.

**Patients maintained on oral glucocorticosteroids**

Pulmicort Turbohaler may permit replacement or significant reduction in dosage of oral glucocorticosteroids while maintaining asthma control. When transferral from oral steroids to Pulmicort Turbohaler is started, the patient should be in a relatively stable phase. A high dose of Pulmicort Turbohaler is then given in combination with the previously used oral steroid dose for about 10 days. After that, the oral steroid dose should be gradually reduced (by for example 2.5 milligrams prednisolone or the equivalent each month) to the lowest possible level. In many cases, it is possible to completely substitute the oral steroid with Pulmicort Turbohaler. For further information on the withdrawal of corticosteroids, see section 4.4.

Initially, Pulmicort Turbohaler should be used concurrently with the patient's usual maintenance dose of oral glucocorticosteroid. After approximately one week the oral dose is gradually reduced to the lowest possible level. A slow rate of withdrawal is strongly recommended. In a number of cases it has been possible to completely substitute the oral glucocorticosteroid with Pulmicort Turbohaler.

During withdrawal, some patients may experience symptoms of systemic corticosteroid withdrawal, e.g. joint and/or muscular pain, lassitude and depression, despite maintenance or even improvement in pulmonary function. Such patients should be encouraged to continue with Pulmicort Turbohaler but should be monitored for objective signs of adrenal insufficiency. If evidence of adrenal insufficiency occurs, the systemic corticosteroid doses should be increased temporarily and thereafter withdrawal should be continued more slowly. During periods of stress or during a severe asthma attack, patients transferred to inhaled steroids may require supplementary treatment with systemic corticosteroids.

**Method of administration**

Pulmicort Turbohaler is for oral inhalation.

Pulmicort Turbohaler is inspiratory flow-driven, which means that when the patient inhales through the mouthpiece, the substance will follow the inspired air into the airways.

Note: It is important to instruct the patient/carer:

- To carefully read the instructions for use in the patient information leaflet, which is packed with each Turbohaler.
- To breathe in forcefully and deeply through the mouthpiece, to ensure that an optimal dose is delivered to the lungs.
- Never to breathe out through the mouthpiece.
- To minimise the risk of oropharyngeal candida infection, the patient should rinse their mouth out with water after inhaling.
- That they may not taste or feel any medication when using Pulmicort Turbohaler, due to the small amount of drug dispensed.

**4.3 Contraindications**

Hypersensitivity to the active substance.

## 4.4 Special warnings and precautions for use

Special caution is necessary in patients with active or quiescent pulmonary tuberculosis and in patients with fungal or viral infections in the airways. Patients with active pulmonary tuberculosis may use Pulmicort Turbohaler only if they are simultaneously treated with effective tuberculostatics.

Non steroid-dependent patients: A therapeutic effect is usually reached within 10 days. In patients with excessive mucus secretion in the bronchi, a short (about 2 weeks) additional oral corticosteroid regimen can be given initially.

Steroid-dependent patients: When transfer from oral steroids to Pulmicort Turbohaler is started, the patient should be in a relatively stable phase. A high dose of Pulmicort Turbohaler is then given in combination with the previously used oral steroid dose, for about 10 days. After that the oral steroid dose should be gradually reduced (by for example 2.5 mg prednisolone or the equivalent each month) to the lowest possible level. In many cases, it is possible to completely substitute Pulmicort Turbohaler in place of the oral steroid.

Particular care is needed in patients transferring from oral steroids, since they may remain at risk of impaired adrenal function for a considerable time. Patients, who have required high dose emergency corticosteroid therapy or prolonged treatment at the highest recommended dose of inhaled corticosteroids, may also be at risk of impaired adrenal function. These patients may exhibit signs and symptoms of adrenal insufficiency when exposed to severe stress. Additional systemic corticosteroid treatment should be considered during periods of stress or elective surgery.

Pulmicort Turbohaler is not intended for rapid relief of acute episodes of asthma where an inhaled short-acting bronchodilator is required. If patients find short-acting bronchodilator treatment ineffective, or they need more inhalations than usual, medical attention must be sought. In this situation consideration should be given to the need for increased anti-inflammatory therapy, e.g., higher doses of inhaled budesonide or a course of oral glucocorticosteroid.

Some patients feel unwell in a non-specific way during the withdrawal phase, e.g., pain in muscles and joints. A state of glucocorticoid deficiency should be suspected if, in rare cases, symptoms such as tiredness, headache, nausea and vomiting should occur. In these cases a temporary increase in the dose of oral glucocorticosteroids is sometimes necessary.

Replacement of systemic glucocorticosteroid treatment with inhaled therapy sometimes unmasks allergies, e.g. rhinitis and eczema, which were previously controlled by the systemic drug. These allergies should be symptomatically controlled with an antihistamine and/or topical preparations.

Exacerbations in COPD should be treated with a course of oral corticosteroids and/or an antibiotic.

Patients should be carefully instructed in the correct use of the Pulmicort Turbohaler and its care.

Prolonged or excessive administration may induce systemic corticosteroid effects, with reduction in plasma cortisol levels.

Systemic effects may occur with any inhaled corticosteroid, particularly at high doses prescribed for long periods. These effects are much less likely to occur with inhalation treatment than with oral corticosteroids. Possible systemic effects include Cushing's syndrome, Cushingoid features, adrenal suppression, growth retardation in children and adolescents, decrease in bone mineral density, cataract, glaucoma and more rarely, a range of psychological or behavioural effects including psychomotor hyperactivity, sleep disorders, anxiety, depression or aggression (particularly in children). It is important therefore that the dose of inhaled corticosteroid is titrated to the lowest dose at which effective control of asthma is maintained.

Reduced liver function affects the elimination of corticosteroids, causing lower elimination rate and higher systemic exposure. Be aware of possible systemic side effects.

There is a relatively small, although significant difference between normal and cirrhotic subjects in intravenous pharmacokinetics including longer half life. The pharmacokinetics after oral ingestion of budesonide were affected by compromised liver function as evidenced by increased systemic availability. This is however of limited clinical

importance for Pulmicort Turbohaler, as after inhalation the oral contribution to the systemic availability is relatively small.

Co-treatment with CYP3A inhibitors, e.g. itraconazole, ketoconazole, HIV protease inhibitors and cobicistat-containing products is expected to increase the risk of systemic corticosteroid side effects. Therefore, the combination should be avoided unless the benefit outweighs this increased risk, in which case patients should be monitored for systemic corticosteroid side effects. This is of limited clinical importance for short-term (1-2 weeks) treatment with itraconazole or ketoconazole or other potent CYP3A inhibitors, but should be taken into consideration during long-term treatment.

Oral candidiasis may occur during the therapy with inhaled corticosteroids. This infection may require treatment with appropriate antifungal therapy and in some patients discontinuation of treatment may be necessary (see also section 4.2).

As with other inhalation therapy paradoxical bronchospasm may occur with an immediate increase in wheezing after dosing. If this occurs, treatment with inhaled budesonide should be discontinued immediately, the patient assessed and alternative therapy instituted if necessary.

#### Pneumonia in patients with COPD

An increase in the incidence of pneumonia, including pneumonia requiring hospitalisation, has been observed in patients with COPD receiving inhaled corticosteroids. There is some evidence of an increased risk of pneumonia with increasing steroid dose but this has not been demonstrated conclusively across all studies.

There is no conclusive clinical evidence for intra-class differences in the magnitude of the pneumonia risk among inhaled corticosteroids products.

Physicians should remain vigilant for the possible development of pneumonia in patients with COPD as the clinical features of such infections overlap with the symptoms of COPD exacerbations.

Risk factors for pneumonia in patients with COPD include current smoking, older age, low body mass index (BMI) and severe COPD.

#### Visual disturbance

Visual disturbance may be reported with systemic and topical corticosteroid use. If a patient presents with symptoms such as blurred vision or other visual disturbances, the patient should be considered for referral to an ophthalmologist for evaluation of possible causes which may include cataract, glaucoma or rare diseases such as central serous chorioretinopathy (CSCR) which have been reported after use of systemic and topical corticosteroids.

#### **Paediatric population**

##### **Influence on growth**

It is recommended that the height of children receiving prolonged treatment with inhaled corticosteroids is regularly monitored. If growth is slowed, therapy should be re-evaluated with the aim of reducing the dose of inhaled corticosteroid, if possible, to the lowest dose at which effective control of asthma is maintained. The benefits of the corticosteroid therapy and the possible risks of growth suppression must be carefully weighed. In addition, consideration should be given to referring the patient to a paediatric respiratory specialist.

## **4.5 Interaction with other medicinal products and other forms of interaction**

The metabolism of budesonide is primarily mediated by CYP3A enzymes. Inhibitors of these enzymes, e.g. ketoconazole, itraconazole, HIV protease inhibitors or cobicistat can therefore increase systemic exposure to budesonide several times, see section 4.4.

The combination of Pulmicort with potent CYP3A inhibitors should be avoided unless the benefit outweighs the increased risk of systemic corticosteroid side effects, in which case patients should be monitored for systemic corticosteroid side effects. A reduction of the budesonide dose could be considered. If Pulmicort is co-administered with anti-fungals (such as itraconazole and ketoconazole), the period between treatments should be as long as possible.

Limited data about this interaction for high-dose inhaled budesonide indicate that marked increases in plasma levels (on average four- fold) may occur if itraconazole, 200 mg once daily, is administered concomitantly with inhaled budesonide (single dose of 1000 µg).

Raised plasma concentrations of and enhanced effects of corticosteroids have been observed in women also treated with oestrogens and contraceptive steroids, but no effect has been observed with budesonide and concomitant intake of low dose combination oral contraceptives.

Because adrenal function may be suppressed, an ACTH stimulation test for diagnosing pituitary insufficiency might show false results (low values).

### **Paediatric population**

Interaction studies have only been performed in adults.

## **4.6 Fertility, pregnancy and lactation**

### **Pregnancy**

Most results from prospective epidemiological studies and world-wide post-marketing data have not been able to detect an increased risk for adverse effects for the foetus and newborn child from the use of inhaled budesonide during pregnancy.

It is important for both foetus and mother to maintain an adequate asthma treatment during pregnancy. As with other drugs administered during pregnancy, the benefit of the administration of budesonide for the mother should be weighed against the risks to the foetus.

If treatment with glucocorticosteroids during pregnancy is unavoidable, inhaled glucocorticosteroids should be preferred because of their lower systemic effect compared with the equipotent anti-asthmatic doses of oral glucocorticosteroids.

### **Breast-feeding**

Budesonide is excreted in breast milk. However, at therapeutic doses of Pulmicort Turbohaler no effects on the suckling child are anticipated. Pulmicort Turbohaler can be used during breast feeding.

Maintenance treatment with inhaled budesonide (200 or 400 micrograms twice daily) in asthmatic nursing women results in negligible systemic exposure to budesonide in breast-fed infants.

In a pharmacokinetic study, the estimated daily infant dose was 0.3% of the daily maternal dose for both dose levels, and the average plasma concentration in infants was estimated to be 1/600th of the concentrations observed in maternal plasma, assuming complete infant oral bioavailability. Budesonide concentrations in infant plasma samples were all less than the limit of quantification.

Based on data from inhaled budesonide and the fact that budesonide exhibits linear PK properties within the therapeutic dosage intervals after nasal, inhaled, oral and rectal administrations, at therapeutic doses of budesonide, exposure to the breast-fed child is anticipated to be low.

## **4.7 Effects on ability to drive and use machines**

Pulmicort Turbohaler has no or negligible influence on the ability to drive and use machines.

4.8 Undesirable effects

Tabulated list of adverse reactions

The following definitions apply to the incidence of undesirable effects: Frequencies are defined as: very common ( $\geq 1/10$ ); common ( $\geq 1/100$  to  $< 1/10$ ); uncommon ( $\geq 1/1,000$  to  $< 1/100$ ); rare ( $\geq 1/10,000$  to  $< 1/1,000$ ); very rare ( $< 1/10,000$ ) and not known (cannot be estimated from the available data).

Table 1 Adverse Drug Reactions (ADR) by System Organ Class (SOC) and Frequency

SOC	Frequency	Adverse Drug Reaction
Infections and infestations	Common	Oropharyngeal candidiasis
		Pneumonia (in COPD patients)
Immune system disorders	Rare	Immediate and delayed hypersensitivity reactions including rash, contact dermatitis, urticaria, angioedema and anaphylactic reaction
Endocrine disorders	Rare	Signs and symptoms of systemic corticosteroid effects, including adrenal suppression and growth retardation*
Psychiatric disorders	Uncommon	Anxiety
		Depression
	Rare	Psychomotor hyperactivity
		Sleep disorders
		Aggression
		Behavioural changes (predominantly in children)
Nervous system disorders	Uncommon	Tremor**
Eye disorders	Uncommon	Cataract
		Vision, blurred (see also section 4.4)
	Unknown	Glaucoma
Respiratory, thoracic and mediastinal disorders	Common	Cough
		Hoarseness
		Throat irritation
	Rare	Bronchospasm
		Dysphonia
		Hoarseness***
Skin and subcutaneous tissue disorders	Rare	Bruising
Musculoskeletal and connective tissue disorders	Uncommon	Muscle spasm

\* refer to Paediatric population, below  
\*\* based on frequency reported in clinical trials.  
\*\*\* rare in children

Occasionally, signs or symptoms of systemic glucocorticosteroid-side effects may occur with inhaled glucocorticosteroid, probably depending on dose, exposure time, concomitant and previous corticosteroids exposure, and individual sensitivity (see section 4.4).

**Description of selected adverse reactions**

Possible Candida infection in the oropharynx is due to drug deposition. Advising the patient to rinse the mouth out with water after each dosing, will minimise this risk.

In rare cases, through unknown mechanisms, drugs for inhalation may cause bronchospasm.

In placebo-controlled studies, cataract was also uncommonly reported in the placebo group.

Clinical trials with 13119 patients on inhaled budesonide and 7278 patients on placebo have been pooled. The frequency of anxiety was 0.52% on inhaled budesonide and 0.63% on placebo; that of depression was 0.67% on inhaled budesonide and 1.15% on placebo.

**Paediatric population**

Due to the risk of growth retardation in the paediatric population, growth should be monitored as described in section 4.4.

**Reporting of suspected adverse reactions**

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via:

HPRA Pharmacovigilance  
 Earlsfort Terrace  
 IRL - Dublin 2  
 Tel: +353 1 6764971  
 Fax: +353 1 6762517  
 Website: [www.hpra.ie](http://www.hpra.ie)  
 e-mail: [medsafety@hpra.ie](mailto:medsafety@hpra.ie)

**4.9 Overdose****Symptoms**

Acute overdosage with Pulmicort Turbohaler, even in excessive doses, is not expected to be a clinical problem. The only harmful effect that follows inhalation of large amounts of the drug over a short period, is suppression of hypothalamic-pituitary-adrenal (HPA) function.

**Management**

No special emergency action needs to be taken. Treatment with Pulmicort Turbohaler should be continued at the recommended dose to control the asthma or COPD symptoms.

**5 PHARMACOLOGICAL PROPERTIES****5.1 Pharmacodynamic properties**

Budesonide is a glucocorticosteroid with high local anti-inflammatory effect.

Pharmacotherapeutic group: Other drugs for obstructive airway diseases, inhalants, glucocorticoids. ATC Code: R03B A02.

**Topical anti-inflammatory effect**

The exact mechanisms of action of glucocorticosteroids in the treatment of asthma and COPD are not fully understood. Anti-inflammatory actions, such as inhibition of inflammatory mediator release and inhibition of cytokine-mediated immune response are probably important.

A clinical study in asthmatics comparing inhaled and oral budesonide demonstrated statistically significant evidence of efficacy with inhaled but not oral budesonide compared with placebo. Thus, the therapeutic effect of conventional doses of inhaled budesonide may be largely explained by its direct action on the respiratory tract.

Budesonide has shown anti-anaphylactic and anti-inflammatory effects in provocation studies in patients, manifested as decreased bronchial obstruction in the immediate as well as the late allergic reaction.

After a single dose, improvement of the lung function is achieved within a few hours. However, the full effect of budesonide, as for other glucocorticosteroids, is not achieved until after a couple of days.

#### **Airway reactivity**

Budesonide has been shown to decrease airway reactivity to histamine and methacholine in hyper-reactive patients.

#### **Exercise-induced asthma**

Therapy with inhaled budesonide has effectively been used for prevention of exercise-induced asthma.

#### **Exacerbations of asthma**

Inhaled budesonide, administered once or twice daily, has been shown to reduce exacerbations of asthma in both children and adults.

#### **COPD**

In patients with mild to moderate COPD, twice daily treatment with Pulmicort Turbohaler 400 micrograms, slowed the accelerated annual decline in FEV<sub>1</sub> compared with placebo.

#### **Growth**

An initial small but generally transient reduction in growth (approximately 1 cm) has been observed, which usually occurs within the first year of treatment. Long-term studies in a clinical practice environment suggest that children and adolescents treated with inhaled budesonide on average achieve their adult target height. However, in a long-term double-blind study, in which the budesonide dose was generally not titrated to the lowest effective dose, children and adolescents treated with inhaled budesonide became on average 1.2 cm shorter as adults than those randomised to placebo. See section 4.4 about titration to the lowest effective dose and about monitoring the growth in children.

#### **Paediatric population**

Slit lamp examinations were performed in 157 children (5-16 years old), treated with an average daily dose of 504 µg for 3-6 years. Findings were compared with 111 age-matched asthmatic children. Inhaled budesonide was not associated with an increased occurrence of posterior subcapsular cataract.

#### **Influence on plasma cortisol concentration**

Studies in healthy volunteers with Pulmicort Turbohaler have shown dose-related effects on plasma and urinary cortisol. At recommended doses, Pulmicort Turbohaler causes significantly less effect on the adrenal function than prednisolone 10mg, as shown by ACTH tests.

## **5.2 Pharmacokinetic properties**

#### **Absorption**

Following oral inhalation via Pulmicort Turbohaler, peak plasma concentrations of budesonide (4.0 nmol/L after a dose of 800 µg) occur within 30 minutes. Maximum plasma concentration and area under the plasma concentration time profile increase linearly with dose, but are slightly (20-30%) higher following repeated doses (3 weeks treatment) than after a single dose. Lung deposition in healthy subjects was estimated to 34% ±10% of the metered dose (arithmetic mean ± SD), while 22% was retained in the mouthpiece and the rest (approximately 45% of the metered dose) was swallowed.

#### **Distribution**

Budesonide has a volume of distribution of approximately 3 L/Kg. Plasma protein binding averages 85-90%.



**Biotransformation**

Budesonide undergoes an extensive degree ( $\approx 90\%$ ) of biotransformation on first passage through the liver to metabolites of low glucocorticosteroid activity. The glucocorticosteroid activity of the major metabolites, 6 $\beta$ -hydroxybudesonide and 16 $\alpha$ -hydroxyprednisolone, is less than 1% of that of budesonide.

The metabolism of budesonide is primarily mediated by CYP3A, a subfamily of cytochrome p450.

**Elimination**

The metabolites of budesonide are excreted as such or in conjugated form mainly via the kidneys. No unchanged budesonide has been detected in the urine. Budesonide has a high systemic clearance (approximately 1.2 L/min) in healthy adults and the terminal half-life of budesonide after iv. dosing averages 2-3 hours.

**Linearity**

The kinetics of budesonide are dose-proportional at clinically relevant doses.

**Paediatric population**

Budesonide has a systemic clearance of approximately 0.5 L/min in 4-6 years old asthmatic children. Per kg body weight children have a clearance which is approximately 50% greater than in adults. The terminal half-life of budesonide after inhalation is approximately 2.3 hours in asthmatic children. This is about the same as in healthy adults. In asthmatic children treated with Pulmicort Turbohaler (800  $\mu$ g single dose), plasma concentration reached C<sub>max</sub> (4.85 nmol/L) at 13.8 minutes after inhalation, and then decreased rapidly; AUC was 10.3 nmol·h/L. The value for AUC is generally comparable to that observed in adults at the same dose, however, the C<sub>max</sub> value tends to be higher in children.

Lung deposition in children (31% of the nominal dose) is similar to that measured in healthy adults (34% of nominal dose).

**5.3 Preclinical safety data**

The acute toxicity of budesonide is low and of the same order of magnitude and type as that of the reference glucocorticosteroids studied (beclometasone dipropionate, fluocinolone acetonide).

Results from subacute and chronic toxicity studies, show that the systemic effects of budesonide are less severe than, or similar to, those observed after administration of the other glucocorticosteroids, e.g. decreased body-weight gain and atrophy of lymphoid tissues and adrenal cortex.

An increased incidence of brain gliomas in male rats in a carcinogenicity study, could not be verified in a repeat study in which the incidence of gliomas did not differ between any of the groups on active treatment (budesonide, prednisolone, triamcinolone acetonide) and the control groups.

Liver changes (primary hepatocellular neoplasms) found in male rats in the original carcinogenicity study, were noted again in the repeat study with budesonide, as well as with the reference glucocorticosteroids. These effects are most probably related to a receptor effect and thus represent a class effect.

Available clinical experience shows no indication that budesonide, or other glucocorticosteroids, induce brain gliomas or primary hepatocellular neoplasms in man.

Budesonide has been used successfully for the treatment of asthma for many years.

**6 PHARMACEUTICAL PARTICULARS****6.1 List of excipients**

None.

## 6.2 Incompatibilities

Not applicable.

## 6.3 Shelf life

2 years.

## 6.4 Special precautions for storage

Do not store above 30°C.

Replace the cover properly after use.

## 6.5 Nature and contents of container

The outer protecting parts of the container consist of a tubular cover screwed onto a bottom plate. These parts are made of polyethylene. Inside this is the inhaler with its main parts, a mouthpiece, a dosing mechanism and a substance store.

Each inhaler contains 50 metered doses.

## 6.6 Special precautions for disposal and other handling

No special requirements for disposal.

See Section 4.2.

## 7 MARKETING AUTHORISATION HOLDER

AstraZeneca UK Ltd,  
600 Capability Green,  
Luton,  
LU1 3LU, UK.

## 8 MARKETING AUTHORISATION NUMBER

PA0970/050/007

## 9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of first authorisation: 12<sup>th</sup> Jan 1990

Date of latest renewal: 21<sup>st</sup> Feb 2007

## 10 DATE OF REVISION OF THE TEXT

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