

## PROFESSIONAL INFORMATION

**SCHEDULING STATUS** S4

### 1 NAME OF THE MEDICINE

ASOTRIM (Tablets)

### 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each tablet contains 50 mg azathioprine.

For full list of excipients, see section 6.1.

### 3 PHARMACEUTICAL FORM

Tablets.

Pale yellow, round, biconvex tablet marked AE50 on one side and G on the reverse.

### 4 CLINICAL PARTICULARS

#### 4.1 Therapeutic indications

ASOTRIM is used as an immunosuppressant antimetabolite either alone or, more commonly, in combination with other medicines (usually corticosteroids) and procedures which influence the immune response. Therapeutic effect may be evident only after weeks or months and can include a steroid-sparing effect, thereby reducing the toxicity associated with high dosage and prolonged usage of corticosteroids.

ASOTRIM is indicated for:

- **Transplantation**

ASOTRIM, in combination with corticosteroids and/or other immunosuppressive medicines and procedures, is indicated to enhance the survival of organ transplants, such as renal transplants, cardiac transplants and hepatic transplants. It also reduces the corticosteroid requirement of renal transplant recipients.

- **Inflammatory bowel disease**

ASOTRIM is indicated for the treatment of moderate to severe inflammatory bowel disease (IBD) (Crohn's disease or ulcerative colitis) in patients in whom corticosteroid therapy is required, in patients who cannot tolerate corticosteroid therapy, or in patients whose disease is refractory to other standard first line therapy.

- **Auto-immune diseases**

ASOTRIM, either alone or more usually in combination with corticosteroids and/or other medicines and procedures, has been used with clinical benefit (which may include reduction of dosage or discontinuation of corticosteroids) in a proportion of patients suffering from the following:

- severe rheumatoid arthritis,
- systemic lupus erythematosus,
- dermatomyositis and polymyositis,
- auto-immune active chronic hepatitis,
- pemphigus vulgaris,
- polyarteritis nodosa,
- auto-immune haemolytic anaemia,
- chronic refractory idiopathic thrombocytopenic purpura,
- relapsing remittent multiple sclerosis.

#### **4.2. Posology and method of administration**

Specialist medical literature should be consulted for guidance as to clinical experience in particular conditions.

ASOTRIM tablets should be administered at least one hour before or three hours after food or milk.

## **Posology**

### **Adults**

#### *Transplants*

Depending on the immunosuppressive regimen employed, a loading dosage of up to 5,0 mg/kg bodyweight/day may be given orally or intravenously on the first day of therapy. Maintenance dosage should range from 1,0 to 4,0 mg/kg bodyweight/day orally (or intravenously ONLY if oral therapy is not tolerated) and must be adjusted according to clinical requirements and haematological tolerance.

Evidence indicates that ASOTRIM therapy should be maintained indefinitely, even if only low doses are necessary, because of the risk of graft rejection.

#### *Multiple sclerosis*

The dose recommended for the treatment of relapsing remittent multiple sclerosis is 2 to 3 mg/kg bodyweight/day. Treatment duration in excess of one year may be required to establish efficacy. Control of disease progression may not be apparent until after two years of therapy.

#### *Other indications*

In general, starting dosage is from 1 to 3 mg/kg bodyweight/day, and should be adjusted, within these limits, depending on the clinical response (which may not be evident for weeks or months) and haematological tolerance.

The dosage of ASOTRIM and the duration of treatment may vary according to the condition, its severity and the clinical response obtained. A therapeutic response in auto-immune disease may not be evident for a few days or even weeks after initiation of ASOTRIM therapy. When therapeutic response is evident, consideration should be given to reducing the maintenance dosage to the lowest level compatible with the maintenance of that response. If no improvement occurs in the patient's condition within three months, consideration should be given to withdrawing ASOTRIM. Treatment is otherwise undertaken on a long-term basis unless the patient exhibits evidence of intolerance to ASOTRIM.

However, for patients with IBD, a treatment duration of at least twelve months should be considered and a response to treatment may not be clinically apparent until after three to four months of treatment.

The maintenance dosage required may range from less than 1 mg/kg bodyweight/day to 3 mg/kg bodyweight/day, depending on the clinical condition being treated and the individual patient response, including haematological tolerance.

## **Special populations**

### *Elderly population*

There is limited experience of the administration of ASOTRIM to elderly patients. The dosage of ASOTRIM in the elderly has not been established. Although the available data do not provide evidence that the incidence of side effects among elderly patients is higher than that among other patients treated with ASOTRIM, it is advisable to monitor renal and hepatic function, and to consider dosage reduction if there is impairment. It is recommended that the dosages used are at the lower end of the range given.

### *Renal impairment*

ASOTRIM pharmacokinetics has not been formally studied in patients with renal insufficiency. No specific dose recommendations can be given. Since impaired renal function may result in slower elimination of azathioprine and its metabolites, ASOTRIM should be given at the lowest normal dose (see section 4.4).

### *Hepatic impairment*

ASOTRIM pharmacokinetics has not been formally studied in patients with hepatic impairment. Since impaired hepatic function may result in reduced elimination of azathioprine and its metabolites, no specific dose recommendations can be given. In patients with hepatic insufficiency, ASOTRIM should be given at the lowest normal dose (see section 4.4). Patients should be monitored for dose related adverse effects.

### *Interaction*

When xanthine oxidase inhibitors, such as allopurinol, and azathioprine, as in ASOTRIM are administered concomitantly it is essential that only 25 % of the usual dose of ASOTRIM is given since allopurinol decreases the rate of catabolism of ASOTRIM (see section 4.5).

### *TPMT-deficient patients*

Patients with inherited little or no thiopurine S-methyltransferase (TPMT) activity are at increased risk for severe toxicity from conventional doses of azathioprine, as in ASOTRIM, and generally require substantial dose reduction. The optimal starting dose for homozygous deficient patients has not been established (see section 4.4). Most patients with heterozygous TPMT deficiency can tolerate recommended ASOTRIM doses, but some may require dose reduction. Genotypic and phenotypic tests of TPMT are available (see section 4.4).

Fatal cases of myelosuppression in patients with low or absent TPMT activity treated with thiopurines have been reported. This problem could be exacerbated by coadministration with medicines that inhibit TPMT, such as olsalazine, mesalazine or sulfasalazine.

#### *Patients with NUDT15 variant*

Patients with inherited mutated NUDT15 gene are at increased risk for severe thiopurine toxicity, such as early leukopenia and alopecia, from conventional doses of thiopurine therapy and generally require substantial dose reduction. Patients of Asian ethnicity are particularly at risk, due to the increased frequency of the mutation in this population. The optimal starting dose for heterozygous or homozygous deficient patients has not been established.

Genotypic and phenotypic testing of NUDT15 variants should be considered before initiating thiopurine therapy in all patients (including paediatric patients) to reduce the risk of thiopurine-related severe leukocytopenia and alopecia, especially in Asian populations (see section 5.2).

#### **Paediatric population**

The use of ASOTRIM is not recommended in children with multiple sclerosis.

For transplants and other indications, the posology is as in adults.

#### *Overweight paediatric population*

Children considered to be overweight may require doses at the higher end of the dose range and therefore close monitoring of response to treatment is recommended (see section 5.2).

ASOTRIM tablets are given by mouth, but patients unable to take oral medicine may be given

intravenously for a short period. It is seldom necessary to continue with the injection for more than a day or two and ASOTRIM tablets should be substituted as soon as possible.

### 4.3 Contraindications

- Patients with hypersensitivity to azathioprine or to any of the excipients in ASOTRIM (see section 6.1). Hypersensitivity to 6-mercaptopurine (6-MP) should alert the prescriber to probable hypersensitivity to ASOTRIM.
- Pregnancy and lactation.
- Patients who may be pregnant, who are likely to become pregnant in the near future, or who are known to be pregnant.
- Acute infections.
- Patients with rheumatoid arthritis previously treated with alkylating agents (cyclophosphamide, chlorambucil, melphalan or others) may have a prohibitive risk of neoplasia if treated with ASOTRIM.

### 4.4 Special warnings and precautions for use

#### *Hypersensitivity*

Patients suspected to have previously presented a hypersensitivity reaction to 6-mercaptopurine (6-MP) should not be treated with its pro-drug azathioprine, after allergological tests have confirmed the medicine the patient is allergic to. In many cases, re-challenge has confirmed an association with ASOTRIM. It has been suggested that the imidazole sidechain gives rise to sensitivity, whereas the 6-MP molecule gives rise to cholestasis.

#### *Immunisation*

Immunisation using a live organism vaccine has the potential to cause infection in immunocompromised hosts. Therefore, it is recommended that patients do not receive live organism

vaccines until at least three months after the end of their treatment with azathioprine (see section 4.5).

### *Ribavirin*

Co-administration of ribavirin and ASOTRIM is not advised. Ribavirin may reduce efficacy and increase toxicity of ASOTRIM (see section 4.5).

### *Monitoring*

THE RISKS ASSOCIATED WITH ASOTRIM THERAPY SHOULD BE CONSIDERED AGAINST THE SEVERITY OF THE PATIENT'S CONDITION AND THE EXPECTED BENEFICIAL CLINICAL EFFECT

There are potential hazards in the use of ASOTRIM. ASOTRIM should be prescribed only if the patient can be adequately monitored for toxic effects throughout the duration of the therapy.

Particular care should be taken to monitor haematological response and to reduce the maintenance dosage to the minimum required for clinical response.

It is suggested that during the first 8 weeks of therapy, complete blood counts, including platelets, should be performed weekly or more frequently if high dosage is used or if severe renal and/or hepatic disorder is present. The blood count frequency may be reduced later in therapy, but it is suggested that complete blood counts are repeated monthly, or at least at intervals of no longer than three months.

At the first signs of an abnormal fall in blood counts, treatment should be interrupted immediately as leucocytes and platelets may continue to fall after treatment is stopped.



Patients receiving ASOTRIM should be instructed to report immediately any evidence of infection, unexpected bruising or bleeding or other manifestations of bone-marrow depression. Bone marrow suppression is reversible if ASOTRIM is withdrawn early enough.

ASOTRIM is hepatotoxic and liver function tests should be routinely monitored during treatment. More frequent monitoring may be advisable in those with pre-existing liver disease or receiving other potentially hepatotoxic therapy. The patient should be instructed to discontinue ASOTRIM immediately if jaundice becomes apparent.

If ASOTRIM is used in conjunction with, or soon after, withdrawal of another medicine known to have a depressive effect on the bone marrow, it is particularly important that frequent blood counts be taken. Since ASOTRIM may have a delayed action, it is important to reduce dosage or withdraw the medicine temporarily at the first sign of an abnormally large fall in leucocyte count and/or other evidence of persistent depression of the bone marrow. Such bone marrow depression is usually reversible at the doses recommended for auto-immune disease.

The effect on white cell count is not closely correlated with the immunosuppressive effect of ASOTRIM; a good immunosuppressive effect can often be obtained without change in the white cell count, but sometimes the count may be greatly reduced without any apparent immunosuppression.

#### *Thiopurine methyltransferase*

There are individuals with an inherited deficiency of the enzyme thiopurine methyltransferase (TPMT) who may be unusually sensitive to the myelosuppressive effect of azathioprine, as in ASOTRIM and prone to developing rapid bone marrow depression following the initiation of treatment with ASOTRIM. This problem could be exacerbated by coadministration with medicines

that inhibit TPMT, such as olsalazine, mesalazine or sulphasalazine. Also, a possible association between decreased TPMT activity and secondary leukaemias and myelodysplasia has been reported in individuals receiving 6-MP (the active metabolite of azathioprine) in combination with other cytotoxics (see section 4.8). Some laboratories offer testing for TPMT deficiency, although these tests have not been shown to identify all patients at risk of severe toxicity. Therefore, close monitoring of blood counts is still necessary. The dosage of ASOTRIM may need to be reduced when ASOTRIM is combined with other medicines whose primary or secondary toxicity is myelosuppression (see section 4.5).

#### *NUDT15 mutation*

Patients with inherited mutated NUDT15 gene are at increased risk for severe thiopurine toxicity, such as early leukopenia and alopecia, from conventional doses of thiopurine therapy and generally require substantial dose reduction. Patients of Asian ethnicity are particularly at risk, due to the increased frequency of the mutation in this population. The optimal starting dose for heterozygous or homozygous deficient patients has not been established. Genotypic and phenotypic testing of NUDT15 variants should be considered before initiating thiopurine therapy in all patients (including paediatric patients) to reduce the risk of thiopurine-related severe leukocytopenia and alopecia, especially in Asian populations (see section 5.2).

#### *Renal and/or hepatic impairment*

Caution is advised during the administration of ASOTRIM in patients with renal impairment and/or hepatic impairment. Consideration should be given to reducing the starting dosage in these patients and haematological response should be carefully monitored (see section 4.2 and section 5.2).

The dosage of ASOTRIM must be reduced for the treatment of active chronic hepatitis. Patients with impaired renal and/or hepatic function may eliminate the medicine and its metabolites at a reduced

rate with a consequent cumulative effect. The dosage of ASOTRIM should therefore be reduced in such cases, particularly in anuric patients.

If there is evidence of toxic hepatitis or biliary stasis, consideration must be given to withholding ASOTRIM. Elevated serum bilirubin levels have been observed in some patients after initiation of ASOTRIM therapy (see section 4.8).

#### *Lesch-Nyhan syndrome*

Limited evidence suggests that ASOTRIM is not beneficial to patients with hypoxanthine-guanine-phosphoribosyltransferase deficiency (Lesch-Nyhan syndrome). Therefore, given the abnormal metabolism in these patients, they should not receive ASOTRIM.

#### *Infection*

ASOTRIM has an immunosuppressant effect involving both antibody and cell-mediated immunity. Infection, which is always a hazard of immunosuppressive therapy, particularly when corticosteroids are given, may require the dosage of immunosuppressive medicine to be reduced temporarily. Fungal, protozoal, viral and uncommon bacterial infections in patients on immunosuppressive therapy have occurred and should be treated vigorously. Some of these have proved fatal.

#### *Gastrointestinal intolerance*

ASOTRIM may cause anorexia, nausea, vomiting or diarrhoea. In such cases ASOTRIM therapy may have to be adjusted.

#### *Other*

Persistent negative nitrogen balance has been observed in some patients on continuous ASOTRIM and corticosteroid therapy. If this occurs, the dosage should be reduced.

The effects of azathioprine and its metabolite, mercaptopurine may persist after clearance is complete and therefore it is important to reduce or withdraw the medication at the first sign of abnormally large fall in the leucocyte count or other evidence of bone marrow depression.

Bone-marrow depression with main effect on the granulocytes and slight effect on platelets. The bone-marrow depression may be severe and irreversible and manifested by leucopenia, anaemia, thrombocytopenia and bleeding.

Medicine fever, pancreatitis, muscle wasting and skin rashes have been reported and oral lesions and skin reactions may occur.

ASOTRIM should be used with care in patients with liver damage or a history of liver disease.

If infection develops during treatment ASOTRIM should be withdrawn. Allopurinol enhances the effects of ASOTRIM and the dose of ASOTRIM should be reduced to about one quarter when allopurinol is given concomitantly.

Reduced doses may be required in patients with renal transplants.

### *Mutagenicity*

Chromosomal abnormalities have been demonstrated in both male and female patients treated with azathioprine, as in ASOTRIM. It is difficult to assess the role of ASOTRIM in the development of these abnormalities.

Chromosomal abnormalities, which disappear in time, have been demonstrated in lymphocytes from

the offspring of patients treated with ASOTRIM.

Except in extremely rare cases, no overt physical evidence of abnormality has been observed in the offspring of patients treated with ASOTRIM (see section 4.6).

Azathioprine, as in ASOTRIM, and long-wave ultraviolet light have been shown to have a synergistic clastogenic effect in patients treated with azathioprine, as in ASOTRIM, for a range of disorders.

### *Carcinogenicity*

Patients receiving immunosuppressive therapy, including ASOTRIM, are at an increased risk of developing lymphoproliferative disorders and other malignancies, notably skin cancers (melanoma and non-melanoma), sarcomas (Kaposi's and non-Kaposi's) and uterine cervical cancer in situ. The increased risk appears to be related to the degree and duration of immunosuppression. It has been reported that discontinuation of immunosuppression may provide partial regression of the lymphoproliferative disorder.

A treatment regimen containing multiple immunosuppressants (including thiopurines) should therefore be used with caution as this could lead to lymphoproliferative disorders, some with reported fatalities. A combination of multiple immunosuppressants, given concomitantly increases the risk of Epstein-Barr virus (EBV)-associated lymphoproliferative disorders.

Reports of hepatosplenic T-cell lymphoma have been received when azathioprine, as in ASOTRIM, is used alone or in combination with anti-TNF medicines or other immunosuppressants. Although most reported cases occurred in the IBD population, there have also been cases reported outside of this population.

Patients receiving multiple immunosuppressive medicines may be at risk of over-immunosuppression, therefore such therapy should be maintained at the lowest effective level.

As is usual for patients with increased risk for skin cancer, exposure to sunlight and UV light should be limited, and patients should wear protective clothing and use a sunscreen with a high protection factor.

### *Macrophage activation syndrome*

Macrophage activation syndrome (MAS) is a known, life-threatening disorder that may develop in patients with autoimmune conditions, in particular with IBD, and there could potentially be an increased susceptibility for developing the condition with the use of ASOTRIM. If MAS occurs, or is suspected, evaluation and treatment should be started as early as possible, and treatment with ASOTRIM should be discontinued. Physicians should be attentive to symptoms of infection such as EBV and cytomegalovirus (CMV), as these are known triggers for MAS.

### *Varicella Zoster virus infection*

Infection with varicella zoster virus (VZV; chickenpox and herpes zoster) may become severe during the administration of immunosuppressants. Caution should be exercised especially with respect to the following:

Before starting the administration of immunosuppressants, the prescriber should check to see if the patient has a history of VZV. Serologic testing may be useful in determining previous exposure. Patients who have no history of exposure should avoid contact with individuals with chickenpox or herpes zoster. If the patient is exposed to VZV, special care must be taken to avoid patients developing chickenpox or herpes zoster, and passive immunisation with varicella-zoster immunoglobulin (VZIG) may be considered.

If the patient is infected with VZV, appropriate measures should be taken, which may include antiviral therapy and supportive care.

#### *Progressive multifocal leukoencephalopathy*

Progressive multifocal leukoencephalopathy (PML), an opportunistic infection caused by the John Cunningham virus (JC virus), has been reported in patients receiving azathioprine, as in ASOTRIM, with other immunosuppressive medicines. Immunosuppressive therapy should be withheld at the first sign or symptoms suggestive of PML and appropriate evaluation undertaken to establish a diagnosis (see section 4.8).

#### *Hepatitis B*

Hepatitis B virus (HBV) carriers (defined as patients positive for hepatitis B surface antigen (HBsAg) for more than six months), or patients with documented past HBV infection, who receive immunosuppressive medicines are at risk of reactivation of HBV replication, with asymptomatic increases in serum HBV DNA and ALT levels. Local guidelines may be considered including prophylactic therapy with oral anti-HBV medicines (see section 4.8).

#### *Xanthine oxidase inhibitors*

If allopurinol, oxipurinol and/or thiopurinol are given concomitantly with azathioprine, as in ASOTRIM, the dosage of ASOTRIM must be reduced to a quarter of the original dose (see section 4.2).

#### *Neuromuscular medicines*

Special care is necessary when muscle relaxants are administered to patients taking ASOTRIM as the action of non-depolarising neuromuscular blockers may be inhibited (see section 4.5).

ASOTRIM can also potentiate the neuromuscular block that is produced by depolarising medicines such as succinylcholine (see section 4.5). Patients should be advised to inform their anaesthesiologist of their treatment with ASOTRIM prior to surgery.

#### **4.5 Interaction with other medicines and other forms of interaction**

##### *Vaccines*

The immunosuppressive activity of azathioprine, as in ASOTRIM, could result in an atypical and potentially deleterious response to live vaccines. It is therefore recommended that patients do not receive live vaccines until at least three months after the end of their treatment with ASOTRIM (see section 4.4).

A diminished response to killed vaccines is likely and such a response to hepatitis B vaccine has been observed among patients treated with a combination of azathioprine, as in ASOTRIM, and corticosteroids. Contributing causes to a suboptimal response to the hepatitis B vaccine include genetic predisposition, immunosuppression, certain chronic illnesses (for example, HIV and AIDS, chronic kidney disease) and age.

A small clinical study has indicated that standard therapeutic doses of azathioprine, as in ASOTRIM, do not deleteriously affect the response to polyvalent pneumococcal vaccine, as assessed on the basis of mean anti-capsular specific antibody concentration.

##### *Ribavirin*

Ribavirin inhibits the enzyme, inosine monophosphate dehydrogenase (IMPDH), leading to a lower production of the active 6-thioguanine nucleotides. Severe myelosuppression has been reported following concomitant administration of azathioprine, as in ASOTRIM, and ribavirin; therefore, co-administration is not advised (see section 4.4).



#### *Allopurinol/oxipurinol/thiopurinol and other xanthine oxidase inhibitors*

Xanthine oxidase activity is inhibited by allopurinol, oxipurinol and thiopurinol which results in reduced conversion of biologically active 6-thioinosinic acid to biologically inactive 6-thiouric acid. When allopurinol, oxipurinol and/or thiopurinol are given concomitantly with 6-MP or azathioprine, as in ASOTRIM, the dose of 6-MP and ASOTRIM should be reduced to 25 % of the original dose.

Other xanthine oxidase inhibitors, such as febuxostat may decrease the metabolism of azathioprine, as in ASOTRIM. Concomitant administration is not recommended as data are insufficient to determine an adequate dose reduction.

#### *Neuromuscular blocking medicines*

Azathioprine inhibits phosphodiesterase activity in motor nerve terminals increasing the release of acetylcholine. There is clinical evidence that azathioprine antagonises the effect of non-depolarising muscle relaxants such as curare, d-tubocurarine and pancuronium. Experimental data confirm that ASOTRIM reverses the neuromuscular blockade produced by d-tubocurarine and show that ASOTRIM potentiates the neuromuscular blockade produced by succinylcholine (see section 4.4).

#### *Cytostatic/myelosuppressive medicines*

Where possible, concomitant administration of cytostatic medicines, or medicines which may have a myelosuppressive effect, such as penicillamine, should be avoided.

There are conflicting clinical reports of interactions, resulting in serious haematological abnormalities, between azathioprine, as in ASOTRIM, and trimethoprim/sulfamethoxazole also known as co-trimoxazole. Medicines which may affect leukocyte production, including co-trimoxazole, may lead to exaggerated leukopenia, especially in renal transplant recipients.

There have been case reports suggesting that haematological abnormalities may develop due to the concomitant administration of ASOTRIM and angiotensin converting enzyme (ACE) inhibitors (e.g., captopril).

The use of ACE inhibitors to control hypertension in patients on azathioprine, as in ASOTRIM, has been reported to induce severe leukopenia.

It has been suggested that cimetidine and indomethacin may have myelosuppressive effects, which may be enhanced by concomitant administration of ASOTRIM.

#### *Diuretics*

Furosemide has been shown to impair the metabolism of azathioprine by human hepatic tissue *in vitro*. The clinical significance is unknown.

#### *Aminosalicylates*

There is *in vitro* and *in vivo* evidence that aminosalicylate derivatives (e.g., olsalazine, mesalazine or sulphasalazine) inhibit the TPMT enzyme. Therefore, lower doses of ASOTRIM may need to be considered when administered concomitantly with aminosalicylate derivatives (see section 4.4).

#### *Methotrexate*

Methotrexate (20 mg/m<sup>2</sup> orally) increased 6-MP AUC by approximately 31 % and methotrexate (2 or 5 g/m<sup>2</sup> intravenously) increased 6-MP AUC by 69 % and 93 %, respectively. Therefore, when ASOTRIM is administered concomitantly with high dose methotrexate, the dose should be adjusted to maintain a suitable white blood cell count.

### *Infliximab*

An interaction has been observed between azathioprine, as in ASOTRIM, and infliximab. Patients receiving ongoing azathioprine experienced transient increases in 6-TGN (6-thioguanine nucleotide, an active metabolite of azathioprine) levels and a decrease in the mean leukocyte count in the initial weeks following infliximab infusion, which returned to previous levels after three months.

### *Anticoagulants*

Inhibition of the anticoagulant effect of warfarin and acenocoumarol has been reported when co-administered with azathioprine, as in ASOTRIM; therefore, higher doses of the anticoagulant may be needed. It is recommended that coagulation tests (INR and/or PT) are closely monitored when oral anticoagulants (warfarin) are concurrently administered with ASOTRIM.

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

### **Pregnancy**

ASOTRIM can cause foetal harm when administered to pregnant women.

ASOTRIM should not be given to patients who are pregnant or likely to become pregnant in the near future.

Substantial transplacental and trans-amniotic transmission of azathioprine, as in ASOTRIM, and its metabolites from the mother to the foetus have been shown to occur.

ASOTRIM should not be given to patients who are pregnant or likely to become pregnant in the near future without careful assessment of risk versus benefit.

Evidence of the teratogenicity of ASOTRIM in man is equivocal. As with all cytotoxic chemotherapy,

adequate contraceptive precautions should be advised when either partner is receiving ASOTRIM.

There have been a few reports of congenital deformity when the father was receiving ASOTRIM at the time of conception.

### *Mutagenicity*

Chromosomal abnormalities, which disappear with time, have been demonstrated in lymphocytes from the offspring of patients treated with ASOTRIM. Except in extremely rare cases, no overt physical evidence of abnormality has been observed in the offspring of patients treated with ASOTRIM. Azathioprine, as in ASOTRIM, and long-wave ultraviolet light have been shown to have a synergistic clastogenic effect in patients treated with azathioprine, as in ASOTRIM, for a range of disorders (see section 4.4).

There have been reports of intra-uterine growth retardation, premature birth and low birth weight following maternal exposure to azathioprine, as in ASOTRIM, particularly in combination with corticosteroids.

There have also been reports of spontaneous abortion following either maternal or paternal exposure.

Leukopenia and/or thrombocytopenia have been reported in a proportion of neonates whose mothers took azathioprine, as in ASOTRIM, throughout their pregnancies.

Extra care in haematological monitoring is advised during pregnancy.

### **Breastfeeding**

ASOTRIM and/or its metabolites, such as 6-MP, have been identified in the colostrum and breastmilk of women receiving treatment with azathioprine, as in ASOTRIM.

It is recommended that mothers receiving ASOTRIM should not breastfeed.

## **Fertility**

The specific effect of azathioprine, as in ASOTRIM, therapy on human fertility is unknown but there are reports of successful fatherhood/motherhood after receiving treatment.

Several studies report that azathioprine, as in ASOTRIM, at standard doses does not appear to affect male fertility.

Relief of chronic renal insufficiency by renal transplantation involving the administration of ASOTRIM has been accompanied by increased fertility in both male and female transplant recipients.

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

ASOTRIM has a moderate influence on the ability to drive and use machines.

Since adverse reactions such as dizziness and retinopathy have been reported in patients receiving ASOTRIM, patients should not drive, use machinery or perform any tasks that require concentration, until they are certain that ASOTRIM does not adversely affect their ability to do so (see section 4.8).

#### 4.8 Undesirable effects

##### a. *Tabulated list of adverse reactions*

| System organ class                                                             | Frequent                                                                                                                | Less frequent                                                                                                                                                                                                               | Frequency unknown                           |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>Infections and infestations</b>                                             | Viral, fungal, and bacterial infections in transplant patients receiving ASOTRIM in combination with immunosuppressants | Viral, fungal, and bacterial infections in other patient populations, cases of JC virus associated PML have been reported following the use of ASOTRIM in combination with other immunosuppressants                         | Protozoal and uncommon bacterial infections |
| <b>Neoplasm benign, malignant and unspecified (including cysts and polyps)</b> |                                                                                                                         | Neoplasms including lymphoproliferative disorders, skin cancers (melanoma and non-melanoma), sarcomas (Kaposi's and non-Kaposi's) and uterine cervical cancer in situ, acute myeloid leukaemia and myelodysplastic syndrome | Hepatosplenic T-cell lymphoma               |

|                                                 |                                                         |                                                                                                                                                                                      |                                   |
|-------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>Blood and the lymphatic system disorders</b> | Leukopenia, depression of bone marrow, thrombocytopenia | Anaemia, agranulocytosis, pancytopenia, aplastic anaemia, megaloblastic anaemia, bone marrow failure, erythroid hypoplasia                                                           |                                   |
| <b>Immune system disorders</b>                  |                                                         | Hypersensitivity (including skin rashes, pruritus and erythema, often of an area previously irradiated), erythema nodosum Stevens-Johnson syndrome, toxic epidermal necrolysis (TEN) | Anaphylaxis                       |
| <b>Metabolism and nutrition disorders</b>       |                                                         |                                                                                                                                                                                      | Hyperphosphataemia, anorexia      |
| <b>Nervous system disorders</b>                 |                                                         |                                                                                                                                                                                      | Headache, dizziness               |
| <b>Eye disorders</b>                            |                                                         |                                                                                                                                                                                      | Retinopathy                       |
| <b>Cardiac disorders</b>                        |                                                         |                                                                                                                                                                                      | Cardiac dysrhythmia               |
| <b>Vascular disorders</b>                       |                                                         |                                                                                                                                                                                      | Hypotension, Raynaud's phenomenon |

|                                                        |        |                                                                                                                                                          |                                                                                                                                                                               |
|--------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Respiratory, thoracic and mediastinal disorders</b> |        | Reversible pneumonitis                                                                                                                                   | Pulmonary oedema                                                                                                                                                              |
| <b>Gastrointestinal disorders</b>                      | Nausea | Pancreatitis, colitis, diverticulitis and bowel perforation reported in transplant population, severe diarrhoea in inflammatory bowel disease population | Vomiting, stomatitis, mouth ulceration, oesophagitis, abdominal pain, intestinal haemorrhage, ulceration, peritoneal haemorrhage                                              |
| <b>Hepato-biliary disorders</b>                        |        | Alopecia                                                                                                                                                 | Vesicant or irritant effects on the skin and mucous membranes, pigmentation of the skin and nails, acute febrile neutrophilic dermatosis (Sweet's syndrome), photosensitivity |
| <b>Musculoskeletal and connective tissue disorders</b> |        |                                                                                                                                                          | Muscular pains, arthralgia                                                                                                                                                    |



|                                                             |  |  |                                                                                                   |
|-------------------------------------------------------------|--|--|---------------------------------------------------------------------------------------------------|
| <b>Renal and urinary disorders</b>                          |  |  | Hyperuricaemia and acute renal failure due to uric acid nephropathy                               |
| <b>Reproductive system and breast disorders</b>             |  |  | Suppression of ovarian and testicular function with amenorrhoea and inhibition of spermatogenesis |
| <b>Congenital and familial/genetic disorders</b>            |  |  | Chromosomal abnormalities                                                                         |
| <b>General disorders and administrative site conditions</b> |  |  | Medicine fever, serum sickness, malaise, fever, rigors, weakness                                  |
| <b>Investigations</b>                                       |  |  | Persistent negative nitrogen balance                                                              |

**b. Description of selected adverse reactions**

*Infections and infestations*

Patients receiving azathioprine, as in ASOTRIM alone or in combination with other immunosuppressants, particularly corticosteroids, have shown increased susceptibility to viral, fungal and bacterial infections, including severe or atypical infection, and reactivation with VZV, hepatitis B and other infectious agents (see section 4.4).

*Neoplasms benign, malignant and unspecified (including cysts and polyps)*

Patients receiving immunosuppressive therapy, including ASOTRIM, are at an increased risk of developing lymphoproliferative disorders and other malignancies, notably skin cancers (melanoma and nonmelanoma), sarcomas, (Kaposi's and non-Kaposi's) and uterine cervical cancer in situ. The increased risk appears to be related to the degree and duration of immunosuppression. It has been reported that discontinuation of immunosuppression may provide partial regression of the lymphoproliferative disorder.

There have been reports of acute myeloid leukaemia and myelodysplasia (some in association with chromosomal abnormalities).

*Blood and lymphatic system disorders*

Azathioprine, as in ASOTRIM, may be associated with a dose-related, generally reversible, depression of bone marrow function, most frequently expressed as leukopenia, but also sometimes as anaemia and thrombocytopenia and rarely as agranulocytosis, pancytopenia and aplastic anaemia. These occur particularly in patients predisposed to myelotoxicity, such as those with TPMT deficiency and renal or hepatic insufficiency and in patients failing to reduce the dose of ASOTRIM when receiving concurrent allopurinol therapy.

Reversible, dose-related increases in mean corpuscular volume and red cell haemoglobin content have occurred in association with ASOTRIM therapy. Megaloblastic bone marrow changes have also been observed but severe megaloblastic anaemia and erythroid hypoplasia are rare (see section 4.4).

#### *Immune system disorders*

Several different clinical syndromes, which appear to be idiosyncratic manifestations of hypersensitivity, have been described occasionally following administration of azathioprine, as in ASOTRIM. Clinical features include general malaise, dizziness, nausea, vomiting, diarrhoea, fever, rigors, exanthema, rash, vasculitis, myalgia, arthralgia, hypotension, renal dysfunction, hepatic dysfunction and cholestasis.

In many cases, rechallenge has confirmed an association with azathioprine, as in ASOTRIM.

Immediate withdrawal of ASOTRIM and institution of circulatory support where appropriate have led to recovery in the majority of cases. Other marked underlying pathology has contributed to the very rare deaths reported. Following a hypersensitivity reaction to ASOTRIM, the necessity for continued administration should be carefully considered on an individual basis.

#### *Gastrointestinal disorders*

Some patients experience nausea when first given ASOTRIM. With oral administration, nausea appears to be relieved by administering the tablets after meals. However, administration of ASOTRIM tablets after meals may reduce oral absorption, therefore monitoring for therapeutic efficacy should be considered after administration in this way (see section 4.2 and section 5.2).

Serious complications, including colitis, diverticulitis and bowel perforation, have been described in transplant recipients receiving immunosuppressive therapy. However, the aetiology is not clearly established and high-dose corticosteroids may be implicated. Severe diarrhoea, recurring on rechallenge, has been reported in patients treated with ASOTRIM for IBD. The possibility that exacerbation of symptoms might be medicine-related should be borne in mind when treating such patients.

Pancreatitis has been reported in a small percentage of patients on azathioprine, as in ASOTRIM therapy, particularly in renal transplant patients and those diagnosed as having IBD.

There are difficulties in relating the pancreatitis to the administration of one particular medicine, although re-challenge has confirmed an association with ASOTRIM on occasions.

#### *Hepatobiliary disorders*

Cholestasis and deterioration of liver function have occasionally been reported in association with azathioprine, as in ASOTRIM, therapy and are usually reversible on withdrawal of therapy. This may be associated with symptoms of a hypersensitivity reaction (see section 4.4).

Life-threatening hepatic damage associated with chronic administration of azathioprine, as in ASOTRIM, has been described primarily in transplant patients. Histological findings include sinusoidal dilatation, peliosis hepatis, veno-occlusive disease and nodular regenerative hyperplasia. In some cases, withdrawal of azathioprine, as in ASOTRIM, has resulted in either a temporary or permanent improvement in liver histology and symptoms.

#### *Skin and subcutaneous tissue disorders*

Hair loss has been described on a number of occasions in patients receiving azathioprine, as in

ASOTRIM, and other immunosuppressive medicines. In many instances the condition resolved spontaneously despite continuing therapy.

The relationship between alopecia and ASOTRIM treatment is uncertain.

**c. Paediatric population**

Frequency, type and severity of adverse reactions in children are expected to be the same as in adults.

**d. Reporting of suspected adverse reactions**

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

**SAHPRA:** <https://www.sahpra.org.za/health-products-vigilance/>

**Trinity Pharma (Pty) Ltd:**

**Email:** PV@kahmagroup.co.za

**Tel:** +27 (0)10 594 5610

## **4.9 Overdose**

### **Symptoms**

Nausea, vomiting, diarrhoea, anorexia and severe bone-marrow depression.

Unexplained infection, ulceration of the throat, bruising and bleeding are the main signs of overdose with ASOTRIM and result from bone marrow depression which may be maximal after 9 to 14 days. These signs are more likely to manifest following chronic overdosage, rather than after a single

acute overdose.

There has been a report of a patient who ingested a single overdose of 7,5 g of azathioprine, as in ASOTRIM. The immediate toxic effects of this overdose were nausea, vomiting and diarrhoea, followed by mild leukopenia and mild abnormalities in liver function. Recovery was uneventful.

## **Treatment**

Treatment is symptomatic and supportive. As there is no specific antidote, blood counts should be closely monitored and general supportive measures, together with appropriate blood transfusion, instituted if necessary. Active measures (such as the use of activated charcoal) may not be effective in the event of azathioprine overdose unless the procedure can be undertaken within 60 minutes of ingestion.

Further management should be as clinically indicated or as recommended by the national poisons centre, where available.

The value of dialysis in patients who have taken an overdose of ASOTRIM is not known, though azathioprine is partially dialysable.

## **5 PHARMACOLOGICAL PROPERTIES**

### **5.1 Pharmacodynamic properties**

Category and Class: A 26 Cytostatic agents

Pharmacotherapeutic group: Antineoplastic and immunomodulating agents, Immunosuppressants.

ATC code: L04AX01

### **Mechanism of action**

Azathioprine, a derivative of mercaptopurine, is an antimetabolite of the purine class and possesses immunosuppressive properties.

Azathioprine is a pro-drug of 6-MP. 6-MP is inactive but acts as a purine antagonist and requires cellular uptake and intracellular anabolism to thioguanine nucleotides (TGNs) for immunosuppression. The TGNs and other metabolites (e.g., 6-methyl-mercaptopurine ribonucleotides) inhibit de novo purine synthesis and purine nucleotide interconversions. The TGNs are also incorporated into nucleic acids and this contributes to the immunosuppressive effects of the medicine. Other potential mechanisms of azathioprine include the inhibition of many pathways in nucleic acid biosynthesis, hence preventing proliferation of cells involved in determination and amplification of the immune response. Because of these mechanisms, the therapeutic effect of azathioprine may be evident only after several weeks or months of treatment. The activity of the methylnitroimidazole moiety, a metabolite of azathioprine but not 6-MP, has not been defined clearly. However, in several systems it appears to modify the activity of azathioprine as compared with that of 6-MP.

Plasma levels of azathioprine and 6-MP do not correlate well with the therapeutic efficacy or toxicity of azathioprine, and therefore have no prognostic value.

## **5.2 Pharmacokinetic properties**

### **Absorption**

The absorption of azathioprine is incomplete and variable. The median (range) absolute bioavailability of 6-MP after administration of azathioprine 50 mg is 47 % (27 % to 80 %). The extent of absorption of azathioprine is similar across the gastrointestinal tract, including the stomach, jejunum, and cecum. However, the extent of 6-MP absorption, after azathioprine administration is variable and differs between the sites of absorption, with the highest extent of absorption in the

jejunum, followed by the stomach and then the cecum.

Although there are no food effect studies with azathioprine, pharmacokinetic studies with 6-MP have been conducted that are relevant to azathioprine. The mean relative bioavailability of 6-MP was approximately 26 % lower following administration with food and milk compared to an overnight fast. 6-MP is not stable in milk due to the presence of xanthine oxidase (30 % degradation within 30 minutes). Azathioprine should be administered at least one hour before or three hours after food or milk (see section 4.2).

### **Distribution**

The volume of distribution at steady state ( $V_{dss}$ ) of azathioprine is unknown. The mean ( $\pm$  SD) apparent  $V_{dss}$  of 6-MP is 0,9 ( $\pm$  0,8) L/kg, although this may be an underestimate because 6-MP is cleared throughout the body (and not just in the liver). Approximately 30 % of azathioprine is protein bound. Concentrations of 6-MP in cerebrospinal fluid (CSF) are low or negligible after IV or oral

### **Biotransformation**

Azathioprine is rapidly broken down *in vivo* by glutathione-S-transferase into 6-MP and a methyl-nitroimidazole moiety. The 6-MP readily crosses cell membranes and is extensively metabolised by many multi-step pathways to active and inactive metabolites, with no one enzyme predominating. Because of the complex metabolism, inhibition of one enzyme does not explain all cases of lack of efficacy and/or pronounced myelosuppression. The predominant enzymes responsible for the metabolism of 6-MP or its downstream metabolites are: the polymorphic enzyme thiopurine S-methyltransferase (TPMT) (see section 4.4), xanthine oxidase (see section 4.5), inosine monophosphate dehydrogenase (IMPDH) (see section 4.5), and hypoxanthine guanine phosphoribosyl transferase (HPRT). Additional enzymes involved in the formation of active and inactive metabolites are guanosine monophosphate synthetase (GMPS, which form TGNs) and



inosine triphosphate pyrophosphatase (ITPase). Azathioprine itself is also metabolised by aldehyde oxidase to form 8-hydroxy azathioprine, which may be active. There are also multiple inactive metabolites formed via other pathways.

There is evidence that polymorphisms in the genes encoding the different enzyme systems involved with metabolism of azathioprine may predict adverse drug reactions to azathioprine therapy.

### *Thiopurine S-Methyl transferase*

TPMT activity is inversely related to red blood cell 6-MP derived thioguanine nucleotide concentration, with higher thioguanine nucleotide concentrations resulting in greater reductions in white blood cell and neutrophil counts. Individuals with TPMT deficiency develop very high cytotoxic thioguanine nucleotide concentrations.

Genotypic testing can determine the allelic pattern of a patient. Currently, three alleles—TPMT\*2, TPMT\*3A and TPMT\*3C—account for about 95 % of individuals with reduced levels of TPMT activity. Approximately 0,3 % (1:300) of patients have two non-functional alleles (homozygous-deficient) of the TPMT gene and have little or no detectable enzyme activity. Approximately 10 % of patients have one TPMT non-functional allele (heterozygous) leading to low or intermediate TPMT activity and 90 % of individuals have normal TPMT activity with two functional alleles. There may also be a group of approximately 2 % who have very high TPMT activity. Phenotypic testing determines the level of thiopurine nucleotides or TPMT activity in red blood cells and can also be informative (see section 4.4).

### *NUDT15 R139C (NUDT15 c.415C>T) Variant*

Recent studies indicate that a strong association exists between the NUDT15 variant NUDT15 c.415C>T (p.Arg139Cys) (also known as NUDT15 R139C (rs116855232)), which is thought to lead

to a loss of function of the NUDT15 enzyme, and thiopurine-mediated toxicity such as leukopenia and alopecia. The frequency of NUDT15 c.415C>T has an ethnic variability of 9,8 % in East Asians, 3,9 % in Hispanics, 0,2 % in Europeans and 0,0 % in Africans, indicating an increased risk for the Asian population. Patients who are NUDT15 variant homozygotes (NUDT15 T risk alleles) are at an excessive risk of thiopurine toxicity compared with the C homozygotes.

Reduced thiopurine doses for patients who carry the NUDT15 variants may decrease their risk of toxicity. Therefore, genotypic analysis determining NUDT15 genotype should be determined for all patients, including paediatric patients, prior to initiating thiopurine treatment (see section 4.2). The prescribing physician is advised to establish whether dose reduction is required based on patient response to treatment as well as their genetic profile.

Patients with variants in both the NUDT15 and TPMT enzymes are significantly less tolerant of thiopurines than those with risk alleles in only one of these two genes.

The precise mechanism of NUDT15-associated thiopurine-related toxicity is not understood.

## **Elimination**

After oral administration of 100 mg <sup>35</sup>S-azathioprine, 50 % of the radioactivity was excreted in the urine over 24 hours and 12 % in the faeces after 48 hours. In the urine, the major compound was the inactive oxidised metabolite thiouric acid. Less than 2 % was excreted in the urine as azathioprine or 6-MP. Azathioprine has a high extraction ratio with a total clearance greater than 3 L/min in normal volunteers. There are no data on the renal clearance or half-life of azathioprine. The renal clearance of 6-MP and the half-life of 6-MP are 191 mL/min/m<sup>2</sup> and 0,9 hour respectively.

Mercaptopurine, a metabolite of azathioprine, has been identified in the colostrum and breast milk of

women receiving azathioprine treatment.

## **Special patient populations**

### *Elderly*

No specific studies have been carried out in the elderly.

### *Overweight paediatric population*

In a US clinical study, 18 children (aged 3 to 14 years) were evenly divided into two groups; either a weight to height ratio above or below the 75th percentile. Each child was on maintenance treatment of 6-MP and the dosage was calculated based on their body surface area. The mean AUC (0- $\infty$ ) in the group above the 75th percentile was 2,4 times lower than that for the group below the 75th percentile. Therefore, children considered to be overweight may require azathioprine doses at the higher end of the dose range and close monitoring of response to treatment is recommended.

### *Renal impairment*

Studies with azathioprine have shown no difference in 6-MP pharmacokinetics in uremic patients compared to renal transplant patients. Since little is known about the active metabolites of azathioprine in renal impairment, consideration should be given to reducing the dosage in patients with impaired renal function (see section 4.2). Azathioprine and/or its metabolites are eliminated by haemodialysis, with approximately 45 % of radioactive metabolites eliminated during dialysis of eight hours.

### *Hepatic impairment*

A study with azathioprine was performed in three groups of renal transplant patients: those without liver disease, those with hepatic impairment (but no cirrhosis) and those with hepatic impairment and cirrhosis. The study demonstrated that 6-MP exposure was 1,6 times higher in patients with

hepatic impairment (but no cirrhosis) and six times higher in patients with hepatic impairment and cirrhosis, compared to patients without liver disease. Therefore, consideration should be given to reducing the dosage in patients with impaired hepatic function (see section 4.2).

## **6 PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

#### *Tablet core*

- Microcrystalline cellulose (PH 101)
- Mannitol
- Maize starch
- Povidone K25
- Croscarmellose sodium
- Sodium stearyl fumarate

#### *Coating*

- Methylhydroxy propyl cellulose E15
- Propylene glycol

### **6.2 Incompatibilities**

Not applicable.

### **6.3 Shelf life**

2 years

### **6.4 Special precautions for storage**

Store well-closed below 25 °C and protect from light and moisture.

Store blister packed tablets in the original container below 25 °C and protect from light and moisture.

#### **6.5 Nature and contents of container**

White HDPP containers containing 100 tablets.

PVC/Aluminium blisters of 10 tablets per blister in unit cartons of 100 tablets.

#### **6.6 Special precautions for disposal and other handling**

##### **Safe handling**

Tablets should not be divided.

##### **Disposal**

ASOTRIM tablets should be disposed of in a manner appropriate to the prevailing local regulatory requirements for the destruction of dangerous substances.

### **7 HOLDER OF CERTIFICATE OF REGISTRATION**

TRINITY PHARMA (PTY) LTD.

106 16th Road,

Building 2,

Midrand,

1686,

South Africa

### **8. REGISTRATION NUMBER**

T/26/35

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

20 January 1992

**10 DATE OF REVISION OF THE TEXT**

02 February 2023