1 Trade names

SANDIMMUN® NEORAL®, 25, 50 or 100 mg, gelatin capsules, soft
SANDIMMUN®, 50 mg per mL, concentrate for solution for infusion*

2 Description and composition

Pharmaceutical form

Sandimmun® Neoral® soft gelatine capsules:
25 mg: blue-grey oval shaped gelatin capsule, soft, imprinted with "NVR 25mg" in red
50 mg: yellow-white oblong shaped gelatin capsule, soft, imprinted with "NVR 50mg" in red
100 mg: blue-grey oblong shaped gelatin capsule, soft, imprinted with "NVR 100 mg" in red

Sandimmun® concentrate for solution for infusion*: Clear, brown-yellow, oily solution

Active substance

Each capsule contains 25, 50 or 100 mg of ciclosporin.

Sandimmun Neoral is a new pharmaceutical form of the active ingredient ciclosporin based on the microemulsion principle, which reduces the variability of pharmacokinetic parameters and provides dose linearity of ciclosporin exposure with a more consistent absorption profile and less influence from concomitant food intake. The Sandimmun Neoral formulation is a microemulsion preconcentrate, which in pharmacokinetic and clinical studies has demonstrated that the correlation between trough concentration and exposure to ciclosporin is much stronger when ciclosporin is given as Sandimmun Neoral than when it is given as Sandimmun. The formation of the microemulsion itself takes place in the presence of water, either in the form of a beverage or in the form of the gastric fluid.

The concentrate for solution for infusion* contains 50 mg per mL. Each ampoule of 1 mL contains 50 mg of ciclosporin. Each ampoule of 5 mL contains 250 mg of ciclosporin.

Excipients

Soft gelatine capsules

Capsule content: DL–alpha–tocopherol, ethanol anhydrous, propylene glycol, corn oil–mono–di–triglycerides, macrogolglycerol hydroxystearate (Ph.Eur)/polyoxyl 40 hydrogenated castor oil (NF).

Capsule shell: Iron oxide black (E 172) (25- and 100-mg capsules), titanium dioxide (E 171), glycerol 85%, propylene glycol, gelatine.

Imprint: carminic acid (E 120).

Sandimmun concentrate for solution for infusion*

Ethanol anhydrous, macrogolglycerol ricinoleate (Ph.Eur)/polyoxyl castor oil (NF) (see section 6 Warnings and Precautions).

3 Indications

Transplantation indications

Solid organ transplantation

Prevention of graft rejection following kidney, liver, heart, combined heart-lung, lung or pancreas allogeneic transplantations.

Treatment of transplant rejection in patients previously receiving other immunosuppressive agents.

Bone marrow transplantation

Prevention of graft rejection following bone marrow transplantation.

Prevention or treatment of graft-versus-host disease (GVHD).

Non-transplantation indications

Endogenous uveitis

Active sight-threatening intermediate or posterior uveitis of non-infectious aetiology where conventional therapy fails, or causes unacceptable side effects.

Behçet uveitis with repeated inflammatory attacks involving the retina in patients aged 7-70 years with normal kidney function.

Nephrotic syndrome

Steroid-dependent and steroid-resistant nephrotic syndrome in adults and children, due to glomerular diseases such as minimal change nephropathy, focal and segmental glomerulosclerosis, or membranous glomerulonephritis.

Sandimmun Neoral can be used to induce remissions and to maintain them. It can also be used to maintain steroid-induced remission, allowing withdrawal of steroids.

Rheumatoid arthritis

Treatment of severe, active rheumatoid arthritis, in whom classical slow-acting anti rheumatic agents are inappropriate or ineffective.

Psoriasis

Treatment of severe psoriasis in patients in whom conventional therapy is ineffective or inappropriate.

4 Dosage regimen and administration

Dosage regimen

The daily doses of Sandimmun Neoral should always be given in 2 divided doses.

General target population

Transplantation

Solid organ transplantation

Treatment with Sandimmun Neoral should be initiated within 12 hours before surgery at a dose of 10 to 15 mg/kg given in 2 divided doses. This dose should be maintained as the daily dose for 1 to 2 weeks post-operatively before being gradually reduced in accordance

with blood levels until a maintenance dose of about 2 to 6 mg/kg given in 2 divided doses is reached.

When Sandimmun Neoral is given with other immunosuppressants (e.g. with corticosteroids or as part of a triple or quadruple drug therapy), lower doses (e.g. 3 to 6 mg/kg given in 2 divided doses for the initial treatment) may be used.

If the Sandimmun concentrate for solution for infusion is used, the recommended dose is approximately one-third of the appropriate Sandimmun Neoral dose, and it is recommended that patients be put on oral therapy as soon as possible.

Bone marrow transplantation

The initial dose should be given on the day before transplantation. In most cases, Sandimmun intravenous (i.v.) infusion is preferred for this purpose; the recommended i.v. dose is 3 to 5 mg/kg per day. Infusion is continued at this dose level during the immediate post-transplant period of up to 2 weeks, before a change is made to oral maintenance therapy with Sandimmun Neoral at daily doses of about 12.5 mg/kg given in 2 divided doses.

Maintenance treatment should be continued for at least 3 months (and preferably for 6 months) before the dose is gradually decreased to zero by 1 year after transplantation.

If Sandimmun Neoral is used to initiate therapy, the recommended daily dose is 12.5 to 25 mg/kg given in 2 divided doses, starting on the day before transplantation.

Higher doses of Sandimmun Neoral, or the use of i.v. therapy, may be necessary in the presence of gastrointestinal disturbances which might decrease drug absorption.

In some patients, GVHD occurs after discontinuation of Sandimmun treatment, but usually responds favourably to re-introduction of therapy. Low doses of Sandimmun Neoral should be used to treat mild, chronic GVHD.

Non-transplantation

Endogenous uveitis

For *inducing remission*, initially 5 mg/kg per day orally given in 2 divided doses are recommended until remission of active uveal inflammation and improvement in visual acuity is achieved. In refractory cases, the dose can be increased to 7 mg/kg per day for a limited period.

To achieve initial remission, or to counteract inflammatory ocular attacks, systemic corticosteroid treatment with daily doses of 0.5 to 0.6 mg/kg prednisone or an equivalent may be added if Sandimmun Neoral alone does not control the situation sufficiently.

For *maintenance treatment*, the dose should be slowly reduced to the lowest effective level, which, during the remission phases, should not exceed 5 mg/kg per day.

Nephrotic syndrome

For *inducing remission*, the recommended daily dose, given in 2 divided oral doses.

If the renal function (except for proteinuria) is normal, the recommended daily dose is the following:

- 5 mg/kg for adults and
- 6 mg/kg for children

In patients with impaired renal function, the initial dose should not exceed 2.5 mg/kg per day.

The combination of Sandimmun Neoral with low doses of oral corticosteroids is recommended if the effect of Sandimmun Neoral alone is not satisfactory, especially in steroid-resistant patients.

If no improvement has been observed after 3 months' treatment, Sandimmun Neoral therapy should be discontinued.

The doses need to be adjusted individually according to efficacy (proteinuria) and safety (primarily serum creatinine), but should not exceed 5 mg/kg per day in adults and 6 mg/kg per day in children.

For *maintenance treatment*, the dose should be slowly reduced to the lowest effective level.

Rheumatoid arthritis

For the *first 6 weeks of treatment* the recommended dose is 2.5 mg/kg per day orally given in 2 divided doses. If the effect is insufficient, the daily dose may then be increased gradually as tolerability permits, but should not exceed 4 mg/kg. To achieve full effectiveness, up to 12 weeks of Sandimmun Neoral therapy may be required.

For *maintenance treatment* the dose has to be titrated individually according to tolerability. If a patient is on an effective maximum tolerable dose with no further improvements expected, and has been stable for at least three months, the dose of Sandimmun Neoral should be decreased at 0.5 mg/kg/day increments monthly or bimonthly to the lowest effective dose.

If there is essentially no clinical response by six months, the maximal tolerable dose has been administered for three months, Sandimmun Neoral should be discontinued (after three months of Sandimmun Neoral therapy without response, blood level monitoring of ciclosporin may be of value to evaluate compliance, and/or drug absorption).

Dose adjustment based on creatinine values. If the serum creatinine remains increased by more than 30% above creatinine concentration recorded before starting ciclosporin at more than one measurement, the dosage of Sandimmun Neoral should be reduced. If the serum creatinine increases by more than 50%, a dosage reduction by 50 % is mandatory. These recommendations apply even if the patients' values still lie within the laboratory normal range. If the dose reduction is not successful in reducing levels within one month, Sandimmun Neoral treatment should be discontinued.

Sandimmun Neoral can be given in combination with low-dose corticosteroids and/or non-steroidal anti-inflammatory drugs (see section 6 Warnings and precautions).. Sandimmun Neoral can also be combined with low-dose weekly methotrexate in patients who have insufficient response to methotrexate alone, by using initially 2.5 mg/kg Sandimmun Neoral in 2 divided doses per day, with the option to increase the dose as tolerability permits.

Psoriasis

Due to the variability of this condition, treatment must be individualized. For *inducing remission*, the recommended initial dose is 2.5 mg/kg per day orally given in 2 divided doses. If there is no improvement after 1 month, the daily dose may be gradually increased, but should not exceed 5 mg/kg. Treatment should be discontinued in patients in whom sufficient response of psoriatic lesions cannot be achieved within 6 weeks on 5 mg/kg per day, or in whom the effective dose is not compatible with the established safety guidelines (see section 6 Warnings and precautions).

Initial doses of 5 mg/kg per day are justified in patients whose condition requires rapid improvement. Once satisfactory response is achieved, Sandimmun Neoral may be discontinued and subsequent relapse managed with re-introduction of Sandimmun Neoral at the previous effective dose. In some patients, continuous maintenance therapy may be necessary.

For *maintenance treatment*, doses have to be titrated individually to the lowest effective level, and should not exceed 5 mg/kg per day.

Conversion from Sandimmun to Sandimmun Neoral

The available data indicate that after a 1:1 conversion from Sandimmun to Sandimmun Neoral, the through concentrations of ciclosporin in whole blood are comparable. In many patients, however, higher peak concentrations (C_{max}) and an increased exposure to the drug (AUC) may occur. In a small percentage of patients these changes are more marked and may be of clinical significance. Their magnitude depends largely on the individual variance in the absorption of ciclosporin from the originally used Sandimmun, which is known to be highly variable in its bioavailability. Patients with variable trough levels or very high doses of Sandimmun may be poor or inconsistent absorbers of ciclosporin (e.g. patients with cystic fibrosis, liver transplant patients with cholestasis or poor bile secretion, children or some kidney transplant recipients) who may, on conversion to Sandimmun Neoral, become good absorbers. Therefore, in this population, the increase in bioavailability of ciclosporin following a 1:1 conversion from Sandimmun to Sandimmun Neoral might be greater than usually observed. The dose of Sandimmun Neoral should therefore be down titrated individually according to their target trough level range.

It needs to be emphasized that the absorption of ciclosporin from Sandimmun Neoral is less variable and the correlation between ciclosporin trough concentrations and exposure (in terms of AUC) is much stronger than with Sandimmun. This makes ciclosporin blood trough concentrations a more robust and reliable parameter for therapeutic drug monitoring.

Since the conversion from Sandimmun to Sandimmun Neoral may result in an increased drug exposure, the following rules must be observed:

In *transplant patients* Sandimmun Neoral should be started with the same daily dose as was previously used with Sandimmun. Ciclosporin trough concentrations in whole blood should be monitored initially within 4 to 7 days after the conversion to Sandimmun Neoral. In addition, clinical safety parameters such as serum creatinine and blood pressure are to be monitored during the first 2 months after the conversion. If the ciclosporin trough blood levels are beyond the therapeutic range, and/or worsening of the clinical safety parameters occur, the dosage must be adjusted accordingly.

In *patients treated for non-transplant indications*, Sandimmun Neoral should be started with the same daily dose as was used with Sandimmun. Two, 4 and 8 weeks after the conversion, serum creatinine levels and blood pressure should be monitored. If serum creatinine levels or blood pressure significantly exceed the pre-conversion levels or if serum creatinine levels increase to more than 30% above creatinine levels prior to Sandimmun therapy at more than one measurement, the dose should be reduced (see also ‘Additional precautions’). In case of unexpected toxicity or inefficacy of ciclosporin, blood trough levels should also be monitored.

Conversion between oral ciclosporin formulations

Switching from one oral ciclosporin formulation to another should be made with caution and under physician supervision. The introduction of the new formulation must be made

with monitoring of blood levels of ciclosporin to ensure that pre-conversion levels are attained.

Administration

The dose ranges given for oral administration and i.v. administration are intended to serve as guidelines only. The recommended dose of Sandimmun concentrate for i.v. infusion is approximately one third of the appropriate oral dose. Routine monitoring of ciclosporin blood levels is required; this can be carried out by means of a RIA method based on monoclonal antibodies. The results obtained will serve as a guide for determining the actual dosage required to achieve the desired target concentrations in individual patients.

Method of administration

Oral administration

The daily doses of Sandimmun Neoral should always be given in 2 divided doses.

Sandimmun Neoral capsules should be swallowed whole.

*Sandimmun Neoral oral solution** should be diluted with, preferably, orange or apple juice; however, other drinks such as soft drinks can be used according to individual taste. Immediately before taking the oral solution, it should be stirred well. Owing to its possible interference with the P450-dependent enzyme system, grapefruit juice should be avoided for dilution. The syringe should not come in contact with the diluent. If the syringe is to be cleaned, do not rinse it but wipe the outside with a dry tissue.

Intravenous administration

The types of container suitable for the infusion solution are mentioned (in “Incompatibilities").

Because of the risk of anaphylaxis, *Sandimmun concentrate for i.v. infusion** should be reserved for patients who are unable to take the drug orally. In such cases, it is recommended to change to oral administration as soon as feasible.

The concentrate should be diluted 1:20 to 1:100 with normal saline or 5% glucose, and given as a slow i.v. infusion over approximately 2 to 6 hours. Diluted infusion solutions must be discarded after 24 hours.

Special populations

Geriatric patients (65 years of age or above)

Experience with Sandimmun in the elderly is limited, but no particular problems have been reported following the use of the drug at the recommended dose.

In rheumatoid arthritis clinical trials with ciclosporin, 17.5% of patients were aged 65 or older. These patients were more likely to develop systolic hypertension on therapy, and more likely to show serum creatinine rises ≥ 50% above the baseline after 3 to 4 months of therapy.

Clinical studies of Sandimmun Neoral in transplant and psoriasis patients did not include a sufficient number of subjects aged 65 and over to determine whether they respond differently from younger subjects. Other reported clinical experiences have not identified differences in response between the elderly and younger patients. In general, dose selection for an elderly patient should be cautious, usually starting at the low end of the dosing range, reflecting the greater frequency of decreased hepatic, renal, or cardiac function, and of concomitant disease or other drug therapy.

Pediatric patients (below 18 years)

Experience with Sandimmun Neoral in children is still limited. However, children from 1 year of age have received Sandimmun in standard dosage with no particular problems. In several studies, pediatric patients required and tolerated higher doses of Sandimmun per kg body weight than those used in adults.

5 Contraindications

Hypersensitivity to ciclosporin or to any of the excipients of Sandimmun Neoral.

Hypersensitivity to ciclosporin or to any of the excipients of Sandimmun concentrate for solution for infusion* including hypersensitivity to polyoxyl castor oil.

Rheumatoid arthritis and psoriasis patients with abnormal renal function, uncontrolled hypertension, uncontrolled infection or malignancies should not received Sandimmun Neoral.

Psoriasis patients who are treated with Sandimmun Neoral should not receive concomitant PUVA or UVB therapy, methotrexate or other immunosuppressive agents, coal tar or radiation therapy.

6 Warnings and precautions

All medications

Medication supervision

Sandimmun Neoral and Sandimmun concentrate for solution for infusion should be prescribed only by physicians who are experienced in immunosuppressive therapy, and can provide adequate follow-up, including regular full physical examination, measurement of blood pressure, and control of laboratory safety parameters. Transplantation patients receiving the drug should be managed in facilities with adequate laboratory and supportive medical resources. The physician responsible for maintenance therapy should receive complete information for the follow-up of the patient.

Polyoxyl castor oil in the i.v. formulation and anaphylactoid reactions

Sandimmun concentrate for solution for infusion contains polyoxyl castor oil (see section Description and composition), which following i.v. administration has been reported to cause anaphylactoid reactions. These reactions can consist of flushing of the face and upper thorax, and non-cardiogenic pulmonary oedema, with acute respiratory distress, dyspnoea, wheezing and blood pressure changes and tachycardia. Special caution is therefore necessary in patients who have previously received, by i.v. injection or infusion, preparations containing polyoxyl castor oil (e.g. a preparation containing Cremophor® EL), and in patients with an allergic predisposition. Thus, patients receiving Sandimmun concentrate for solution for infusion should be under continuous observation for at least the first 30 minutes after the start of the infusion and at frequent intervals thereafter. If anaphylaxis occurs, the infusion should be discontinued. An aqueous solution of adrenaline 1:1000 and a source of oxygen should be available at the bedside. Prophylactic administration of an antihistaminic (H_1 + H_2 blocker) prior to Sandimmun concentrate for solution for infusion has also been successfully employed to prevent the occurrence of anaphylactoid reactions.

Lymphomas and other malignancies

Like other immunosuppressants, ciclosporin increases the risk of developing lymphomas and other malignancies, particularly those of the skin. The increased risk appears to be related to the degree and duration of immunosuppression rather than to the use of specific agents. Hence a treatment regimen containing multiple immunosuppressants (including ciclosporin) should be used with caution as this could lead to lymphoproliferative disorders and solid organ tumours, some with reported fatalities (see section 9 Adverse drug reactions).

In view of the potential risk of skin malignancy, patients on Sandimmun Neoral should be warned to avoid excess ultraviolet light exposure.

Infections

Like other immunosuppressants, ciclosporin predisposes patients to the development of a variety of bacterial, fungal, parasitic and viral infections, often with opportunistic pathogens. Activation of latent Polyomavirus infections that may lead to Polyomavirus associated nephropathy (PVAN), especially to BK virus nephropathy (BKVN), or to JC virus associated progressive multifocal leukoencephalopathy (PML) have been observed in patients receiving ciclosporin. These conditions are often related to a high total immunosuppressive burden and should be considered in the differential diagnosis in immunosuppressed patients with deteriorating renal function or neurological symptoms. Serious and/or fatal outcomes have been reported. Effective pre-emptive and therapeutic strategies should be employed particularly in patients on multiple long-term immunosuppressive therapy (see section 9 Adverse drug reactions).

Acute and chronic nephrotoxicity

A frequent and potentially serious complication, an increase in serum creatinine and urea, may occur during the first few weeks of ciclosporin therapy. These functional changes are dose-dependent and reversible, usually responding to dose reduction. During long-term treatment, some patients may develop structural changes in the kidney (e.g. arteriolar hyalinosis, tubular atrophy and interstitial fibrosis) which, in renal transplant patients, must be differentiated from changes due to chronic rejection (see section 9 Adverse drug reactions).

Hepatotoxicity and liver injury

Ciclosporin may also cause dose-dependent, reversible increases in serum bilirubin and, in liver enzymes (see section 9 Adverse drug reactions). There have been solicited and spontaneous reports of hepatotoxicity and liver injury including cholestasis, jaundice, hepatitis and liver failure in patients treated with ciclosporin. Most reports included patients with significant co-morbidities, underlying conditions and other confounding factors including infectious complications and comedications with hepatotoxic potential. In some cases, mainly in transplant patients, fatal outcomes have been reported (see section 9 Adverse drug reactions). Close monitoring of parameters that assess renal and hepatic function is required. Abnormal values may necessitate dose reduction (see sections 4 Dosage regimen and administration and 11 Clinical pharmacology).

Geriatric patients (65 years of age or above)

In elderly patients, renal function should be monitored with particular care.

Monitoring ciclosporin levels in transplant patients

For monitoring ciclosporin levels in whole blood, a specific monoclonal antibody (measurement of parent drug) is preferred; a HPLC method, which also measures the parent drug, can be used as well. If plasma or serum is used, a standard separation protocol (time and temperature) should be followed. For the initial monitoring of liver transplant patients, either the specific monoclonal antibody should be used, or parallel measurements using both the specific monoclonal antibody and the nonspecific monoclonal antibody should be performed, to ensure a dosage that provides adequate immunosuppression.

It must be remembered that the ciclosporin concentration in blood, plasma, or serum is only one of many factors contributing to the clinical status of the patient. Results should therefore serve only as a guide to dosage in relationship to other clinical and laboratory parameters.

Hypertension

Regular monitoring of blood pressure is required during ciclosporin therapy; if hypertension develops, appropriate antihypertensive treatment must be instituted (see section 9 Adverse drug reactions). Preference should be given to an antihypertensive agent that does not interfere with the pharmacokinetics of ciclosporin, e.g. isradipine (see section 7 Interactions).

Blood lipids increased

Since ciclosporin has been reported to induce a reversible slight increase in blood lipids, it is advisable to perform lipid determinations before treatment and after the first month of therapy. In the event of increased lipids being found, restriction of dietary fat and, if appropriate, a dose reduction, should be considered (see section 9 Adverse drug reactions).

Hyperkalemia

Ciclosporin enhances the risk of hyperkalemia, especially in patients with renal dysfunction (see section 9 Adverse drug reactions). Caution is also required when ciclosporin is co-administered with potassium sparing drugs (e.g. potassium sparing diuretics, angiotensin converting enzyme inhibitors, angiotensin II receptor antagonists) and potassium containing drugs as well as in patients on a potassium rich diet (see section 7 Interactions). Control of potassium levels in these situations is advisable.

Hypomagnesemia

Ciclosporin enhances the clearance of magnesium. This can lead to symptomatic hypomagnesaemia, especially in the peri-transplant period (see section 9 Adverse drug reactions). Control of serum magnesium levels is therefore recommended in the peri-transplant period, particularly in the presence of neurological symptom/signs. If considered necessary, magnesium supplementation should be given.

Hyperuricemia

Caution is required in treating patients with hyperuricemia (see section 9 Adverse drug reactions).

Live-attenuated vaccines

During treatment with ciclosporin, vaccination may be less effective; the use of live-attenuated vaccines should be avoided.

Interactions

Caution should be observed while co-administering lercanidipine with ciclosporin (see section 7 Interactions).

Ciclosporin may increase blood levels of concomitant medications that are substrates for the multidrug efflux transporter P-glycoprotein (P-gp) or the organic anion transporter proteins (OATP) such as aliskiren, dabigatran or bosentan. Co-administration of ciclosporin with aliskiren is not recommended. Co-administration of ciclosporin together with dabigatran or bosentan should be avoided. These recommendations are based upon the potential clinical impact of these interactions (see section 7 Interactions).

Special Excipients: Ethanol

The ethanol content (see section Description and composition) should be taken into account when given to pregnant or breast feeding women, in patients presenting with liver disease or epilepsy, in alcoholic patients, or if Sandimmun Neoral or Sandimmun concentrate for solution for infusion is being given to a child.

Driving and using machines

Sandimmun Neoral may cause neurological and visual disturbances (see section 9 Adverse drug reactions). Caution should be exercised when driving a motor vehicle or operating machines. No studies on the effects of Sandimmun Neoral on the ability to drive and use machines have been performed.

Additional precautions in non-transplant indications

Patients with impaired renal function (except in nephrotic syndrome patients with a permissible degree of renal impairment), uncontrolled hypertension, uncontrolled infections, or any kind of malignancy should not receive ciclosporin.

Additional precautions in endogenous uveitis

Since Sandimmun Neoral can impair renal function, it is necessary to assess renal function frequently, and if serum creatinine remains increased to more than 30% above baseline at more than one measurement, to reduce the dosage of Sandimmun Neoral by 25 to 50%. If the increase from baseline exceeds 50%, further reduction should be considered. These recommendations apply even if the patient's values still lie within the laboratory's normal range.

Neoral should be administered with caution in patients with neurological Behcet’s syndrome. The neurological status of patients with neurological Behcet’s syndrome should be carefully monitored.

There is only limited experience with the use of Sandimmun Neoral in children with endogenous uveitis.

Additional precautions in nephrotic syndrome

Since Sandimmun Neoral can impair renal function, it is necessary to assess renal function frequently, and if the serum creatinine remains increased to more than 30% above baseline at more than one measurement, to reduce the dosage of Sandimmun Neoral by 25 to 50 %. If the increase from baseline exceeds 50%, further reduction should

be considered. Patients with abnormal baseline renal function should initially be treated with 2.5 mg/kg per day and must be monitored very carefully.

In some patients, it may be difficult to detect Sandimmun Neoral-induced renal dysfunction because of changes in renal function related to the nephrotic syndrome itself. This explains why, in rare cases, Sandimmun Neoral-associated structural kidney alterations have been observed without increases in serum creatinine. Therefore, renal biopsy should be considered for patients with steroid-dependent minimal-change nephropathy, in whom Sandimmun Neoral therapy has been maintained for more than 1 year.

In patients with nephrotic syndrome treated with immunosuppressants (including ciclosporin), the occurrence of malignancies (including Hodgkin's lymphoma) has occasionally been reported.

Additional precautions in rheumatoid arthritis

Since Sandimmun Neoral can impair renal function, a reliable baseline level of serum creatinine should be established by at least two measurements prior to treatment, and serum creatinine should be monitored at 2-weekly intervals for the first 3 months of therapy and thereafter once a month. After 6 months of therapy, serum creatinine needs to be measured every 4 to 8 weeks depending on the stability of the disease, its comedication, and concomitant diseases. More frequent checks are necessary when the Sandimmun Neoral dose is increased, or concomitant treatment with a non-steroidal anti-inflammatory drug is initiated or its dosage increased (see section 7 Interactions).

If the serum creatinine remains increased to more than 30% above baseline at more than one measurement, the dosage of Sandimmun Neoral should be reduced. If the serum creatinine increases by more than 50%, a dosage reduction by 50% is mandatory. These recommendations apply even if the patient's values still lie within the laboratory's normal range. If dose reduction is not successful in reducing levels within one month, Sandimmun Neoral treatment should be discontinued.

Discontinuation of the drug may also become necessary if hypertension developing during Sandimmun Neoral therapy cannot be controlled by appropriate antihypertensive therapy (see section 7 Interactions).

As with other long-term immunosuppressive treatments (including ciclosporin), an increased risk of lymphoproliferative disorders must be borne in mind. Special caution should be observed if Sandimmun Neoral is used in combination with methotrexate (see section 7 Interactions).

Additional precautions in psoriasis

Since Sandimmun Neoral can impair renal function, a reliable baseline level of serum creatinine should be established by at least two measurements prior to treatment, and serum creatinine should be monitored at 2-weekly intervals for the first 3 months of therapy. Thereafter, if creatinine remains stable, measurements should be made at monthly intervals. If the serum creatinine increases and remains increased to more than 30% above baseline at more than one measurement, the dosage of Sandimmun Neoral must be reduced by 25 to 50%. If the increase from baseline exceeds 50%, further reduction should be considered. These recommendations apply even if the patient's creatinine values still lie within the laboratory's normal range. If dose reduction is not successful in reducing levels within one month, Sandimmun Neoral treatment should be discontinued.

Discontinuation of Sandimmun Neoral therapy is also recommended if hypertension developing during Sandimmun Neoral treatment cannot be controlled with appropriate therapy (see section 7 Interactions).

Elderly patients should be treated only in the presence of disabling psoriasis, and renal function should be monitored with particular care.

There is only limited experience with the use of Sandimmun Neoral in children with psoriasis.

In psoriatic patients on ciclosporin, as in those on conventional immunosuppressive therapy, development of malignancies (in particular of the skin) has been reported. Skin lesions not typical for psoriasis, but suspected to be malignant or pre-malignant should be biopsied before Sandimmun Neoral treatment is started. Patients with malignant or pre-malignant alterations of the skin should be treated with Sandimmun Neoral only after appropriate treatment of such lesions, and if no other option for successful therapy exists.

In a few psoriatic patients treated with ciclosporin, lymphoproliferative disorders have occurred. These were responsive to prompt drug discontinuation.

Patients on Sandimmun Neoral should not receive concomitant ultraviolet B irradiation or PUVA photochemotherapy.

7 Interactions

Of the many drugs reported to interact with ciclosporin, those for which the interactions are adequately substantiated and considered to have clinical implications are listed below.

Interactions resulting in concomitant use not being recommended

During treatment with ciclosporin, vaccination may be less effective, the use of **live-attenuated vaccines** should be avoided (see section 6 Warnings and precautions).

Interactions to be considered

Caution is required for concomitant use of **potassium sparing drugs** (e.g. potassium sparing diuretics, angiotensin converting enzyme inhibitors, angiotensin II receptor antagonists) or potassium containing drugs since they may lead to significant increases in serum potassium (see section 6 Warnings and precautions).

Following concomitant administration of ciclosporin and **lercanidipine**, the AUC of lercanidipine was increased threefold and the AUC of ciclosporin was increased 21%. Therefore caution is recommended when co-administering ciclosporin together with lercanidipine (see section 6 Warnings and precautions).

Care should be taken when using ciclosporin together with **methotrexate** in rheumatoid arthritis patients due to the risk of nephrotoxic synergy (see section 6 Warnings and precautions).

Interactions increasing or decreasing ciclosporin levels to be considered

Various agents are known to either increase or decrease plasma or whole blood ciclosporin levels usually by inhibition or induction of enzymes involved in the metabolism of ciclosporin, in particular CYP3A4. Ciclosporin is a substrate of P-gp, hence inhibitors or inducers of P-gp may alter the concentrations of ciclosporin.

If the concomitant use of drugs known to interact with ciclosporin cannot be avoided, the following basic recommendations should be observed:

- In *transplant patients:* frequent measurement of ciclosporin levels and, if necessary, ciclosporin dosage adjustment are required, particularly during the introduction or withdrawal of the co-administered drug.
- In *non-transplant patients:* the value of ciclosporin blood level monitoring is questionable, as in these patients the relationship between blood level and clinical effects is less well established. If drugs known to increase ciclosporin levels are given concomitantly, frequent assessment of renal function and careful monitoring for ciclosporin-related side effects may be more appropriate than blood level measurement.

Interactions decreasing ciclosporin levels

Barbiturates, carbamazepine, oxcarbazepine, phenytoin; nafcillin, sulfadimidine i.v.; rifampicin; octreotide; probucol; orlistat; *hypericum perforatum* (St. John's wort); ticlopidine, sulfinpyrazone, terbinafine, bosentan.

Interactions increasing ciclosporin levels

Macrolide antibiotics (e.g. erythromycin, -see section 6 Warnings and precautions subsection additional precautions in atopic dermatitis-, azithromycin and clarithromycin); ketoconazole, fluconazole, itraconazole, voriconazole; diltiazem, nicardipine, verapamil; metoclopramide; oral contraceptives; danazol; methylprednisolone (high dose); allopurinol; amiodarone; cholic acid and derivatives; protease inhibitors, imatinib; colchicine; nefazodone.

Other relevant interactions

Drug-food/drink interactions

The concomitant intake of **grapefruit juice** has been reported to increase the bioavailability of ciclosporin (see section 4 Dosage and administration).

Interactions resulting in a potential increased nephrotoxicity

During the concomitant use of a *drug that may exhibit nephrotoxic synergy*, close monitoring of renal function (in particular serum creatinine) should be performed. If a significant impairment of renal function occurs, the dosage of the co-administered drug should be reduced or alternative treatment considered.

Care should be taken when using ciclosporin together with other drugs that exhibit nephrotoxic synergy such as: aminoglycosides (incl. gentamycin, tobramycin), amphotericin B, ciprofloxacin, vancomycin, trimethoprim (+ sulfamethoxazole); non-steroidal anti-inflammatory drugs (incl. diclofenac, naproxen, sulindac); melphalan, histamine H_2-receptor-antagonists (e.g. cimetidine, ranitidine); methotrexate (see section above subsection Interactions resulting in a concomitant use not being recommended).

Concomitant use with tacrolimus should be avoided due to increased potential for nephrotoxicity.

The concomitant use of diclofenac and ciclosporin has been found to result in a significant increase in the bioavailability of diclofenac, with the possible consequence of reversible renal function impairment. The increase in the bioavailability of diclofenac is most probably caused by a reduction of its high first-pass effect. If non-steroidal anti-inflammatory drugs with a low first-pass effect (e.g. acetylsalicylic acid) are given together with ciclosporin, no increase in their bioavailability is to be expected. Non-steroidal anti-inflammatory drugs known to undergo strong first-pass metabolism (e.g.

diclofenac) should be given at doses lower than those that would be used in patients not receiving ciclosporin.

In graft recipients there have been isolated reports of considerable but reversible impairment of kidney function (with corresponding increase in serum creatinine) following concomitant administration of fibric acid derivatives (e.g. bezafibrate, fenofibrate). Kidney function must therefore be closely monitored in these patients. In the event of significant impairment of kidney function the co-medication should be withdrawn.

Interaction resulting in an increased rate of gingival hyperplasia

The concurrent administration of nifedipine with ciclosporin may result in an increased rate of gingival hyperplasia compared with that observed when ciclosporin is given alone. The concomitant use of nifedipine should be avoided in patients in whom gingival hyperplasia develops as a side effect of ciclosporin (see section 9 Adverse drug reactions).

Interactions resulting in an increase of other drug levels

Ciclosporin is also an inhibitor of CYP3A4 and of the multidrug efflux transporter P-gp and may increase plasma levels of co-medications that are substrates of this enzyme and/or transporter.

Ciclosporin may reduce the clearance of digoxin, colchicine, prednisolone, HMG-CoA reductase inhibitors (statins) etoposide, aliskiren, bosentan or dabigatran.

Severe digitalis toxicity has been seen within days of starting ciclosporin in several patients taking digoxin. There are also reports on the potential of ciclosporin to enhance the toxic effects of colchicine such as myopathy and neuropathy, especially in patients with renal dysfunction. If digoxin or colchicine are used concurrently with ciclosporin, close clinical observation is required in order to enable early detection of toxic manifestations of digoxin or colchicine, followed by reduction of dosage or its withdrawal.

Literature and postmarketing cases of myotoxicity, including muscle pain and weakness, myositis, and rhabdomyolysis, have been reported with concomitant administration of ciclosporin with lovastatin, simvastatin, atorvastatin, pravastatin, and, rarely, fluvastatin. When concurrently administered with ciclosporin, the dosage of these statins should be reduced according to label recommendations. Statin therapy needs to be temporarily withheld or discontinued in patients with signs and symptoms of myopathy or those with risk factors predisposing to severe renal injury, including renal failure, secondary to rhabdomyolysis.

If digoxin, colchicine or HMG-CoA reductase inhibitors (statins) are used concurrently with ciclosporin, close clinical observation is required in order to enable early detection of toxic manifestations of the drugs, followed by reduction of its dosage or its withdrawal.

Elevations in serum creatinine were observed in the studies using everolimus or sirolimus in combination with full-dose ciclosporin for microemulsion. This effect is often reversible with ciclosporin dose reduction. Everolimus and sirolimus had only a minor influence on ciclosporin pharmacokinetics. Co-administration of ciclosporin significantly increases blood levels of everolimus and sirolimus.

Ciclosporin may increase the plasma concentrations of repaglinide and thereby increase the risk of hypoglycaemia.

Co-administration of bosentan and ciclosporin in healthy volunteers resulted in an approximately 2-fold increase in bosentan exposure and a 35% decrease in ciclosporin exposure (see above subsection drug interactions decreasing ciclosporin levels and section 6 Warnings and precautions).

Following concomitant administration of ciclosporin and aliskiren, the C_{max} of aliskiren was increased by approximately 2.5 fold and the AUC by approximately 5 fold. However, the pharmacokinetic profile of ciclosporin was not significantly altered (see section 6 Warnings and precautions).

Concomitant administration of dabigatran and ciclosporin leads to increased plasma level of dabigatran due to the P-gp inhibitory activity of ciclosporin (see section 6 Warnings and precautions). Dabigatran has a narrow therapeutic index and an increase in plasma level may be associated with an increased risk of bleeding.

Multiple dose administration of ambrisentan and ciclosporin in healthy volunteers resulted in an approximately 2-fold increase in ambrisentan exposure while the ciclosporin exposure was marginally increased (approximately 10%).

A significant increased exposure in anthracycline antibiotics (e.g doxorubicine, mitoxanthrone, daunorubicine) was observed in oncology patients with the intravenous co-administration of anthracycline antibiotics and very high doses of ciclosporin.

Interactions resulting in decrease of other drug levels

Concomitant administration of ciclosporin and mycophenolate sodium or mofetil in transplant patients may decrease the mean exposure of mycophenolic acid by 20-50% when compared with other immunosuppressants. This information should be taken into consideration when coadministering these drugs.

The coadministration of a single dose of ciclosporin (200 mg or 600 mg) with a single dose of eltrombopag (50 mg) decreased plasma eltrombopag AUCinf by 18% to 24% and Cmax by 25% to 39%. This decrease in exposure is not considered clinically meaningful.

8 Pregnancy, Lactation, females and males of reproductive potential

Pregnancy

Risk summary

There are no adequate or well-controlled clinical studies in pregnant women using ciclosporin. There is a moderate amount of data on the use of ciclosporin in pregnant patients from post-marketing experience, including published literature. Pregnant women receiving immunosuppressive therapies after transplantation, including ciclosporin and ciclosporin-containing regimens, are at risk of premature delivery (<37 weeks). The data have not demonstrated a higher incidence of miscarriages, major birth defects, or maternal events as compared to the rates seen in the general population (see Human data).

Embryo-fetal developmental (EFD) studies in rats and rabbits with ciclosporin have shown embryo-fetal toxicity at dose levels below the maximum recommended human dose (MRHD) based on body surface area (BSA) (see Animal data).

Sandimmun Neoral should not be used during pregnancy unless the expected benefit to the mother outweighs the potential risk to the fetus. The ethanol content should also be taken into account in pregnant women (see section 6 Warnings and precautions).

Data

Human data

Published data from National Transplantation Pregnancy Registry (NTPR), described pregnancy outcomes in female kidney (482), liver (97), and heart (43) transplant recipients receiving ciclosporin. The data indicated successful pregnancies with a live birth rate of 76% and 76.9%, and 64% in kidney, liver, and heart transplant recipients, respectively. Premature delivery (<37 weeks) was reported in 52%, 35%, and 35% of kidney, liver, and heart transplant recipients, respectively.

The rates of miscarriages and major birth defects were reported to be comparable to the rates observed in the general population. No direct effect of ciclosporin on maternal hypertension, pre-eclampsia, infections, or diabetes can be established given the limitations inherent to registries and post-marketing safety reporting.

A limited number of observations in children exposed to ciclosporin in utero is available, up to an age of approximately 7 years. Renal function and blood pressure in these children were normal.

Animal data

Three EFD studies (two oral and one intravenous) are available in rats. In oral EFD studies, pregnant rats were administered with ciclosporin either at doses of 10, 17, 30, 100 and 300 mg/kg/day or 4, 10 and 25 mg/kg/day from gestation day (GD) 6 to 15 or from GD 7 to 17, respectively. Maternal toxicity characterized by mortality, clinical signs of toxicity and impaired body weight gain were observed at 30 mg/kg/day and above. Ciclosporin was embryo- and fetotoxic as indicated by increased embryonic mortality and reduced fetal weight together with skeletal retardations in rats at 25 mg/kg/day and above. In addition, ventricular septal defect was observed at 25 mg/kg/day in fetuses. The no observed effect level (NOEL) for both dams and fetus was 17 mg/kg/day (below the MRHD based on BSA) after oral administration. In the other oral study, the NOEL for dams and fetuses were 10 and 4 mg/kg/day (below the MRHD based on BSA), respectively. In the IV EFD study, rats were administered with 3, 6 and 12 mg/kg/day of ciclosporin from GD 7 to 17. An increase in post implantation loss was observed at 12 mg/kg/day; ventricular septal defect was observed at 6 mg/kg/day and above in fetuses. The NOEL for dams and fetus were 6 and 3 mg/kg/day (below the MRHD based on BSA), respectively, after IV administration.

In rabbits, ciclosporin was orally administered at dose levels of 10, 30, 100 or 300 mg/kg/day from GD 6 to 18. At 100 mg/kg/day and above, reduction in body weight gain of dams and at 300 mg/kg/day abortions were observed. Maternal toxicity, embryo-fetotoxicity as indicated by increased pre- and postnatal mortality, reduced fetal weight together with skeletal retardations were observed at 100 mg/kg/day and above. The NOEL for dams and fetuses was 30 mg/kg/day (below the MRHD based on BSA).

In two published research studies, pregnant rabbits exposed to ciclosporin (10 mg/kg/day subcutaneously) during gestation demonstrated maternal toxicity (reduced body weight gain) and kidney changes in pups and adults (reduced numbers of nephrons, renal hypertrophy, systemic hypertension, and progressive renal insufficiency). An increase in fetal resorptions and a decrease in live pups and pup body weight were observed .

In a peri-and postnatal development study in rats, pregnant rats were orally administered with ciclosporin (5, 15 or 45 mg/kg/day) from GD 15 until end of lactation. At 45 mg/kg/day (below the MRHD based on BSA), increased pre and postnatal mortality of offspring and reduced body weight gain of surviving pups were observed. Ciclosporin up

to 15 mg/kg/day (below the MRHD based on BSA) had no effect on pregnancy, pre and postnatal development of offspring.

Lactation

Risk summary

Ciclosporin is transferred into breast milk. Mothers receiving treatment with Sandimmun Neoral should not breast-feed. Because of the potential of Sandimmun Neoral to cause serious adverse drug reactions in breastfed newborns/infants, a decision should be made whether to abstain from breast-feeding or to abstain from using the medicinal drug, taking into account the benefit of breast-feeding for the newborn/infant and the importance of the medicinal product to the mother.

The milk to maternal blood concentration ratio of ciclosporin was in the range of 0.17 to 1.4. Based on the infant milk intake, the highest estimated ciclosporin dose ingested by fully breast-fed infant was approximately 2% of maternal weight adjusted dose.

The ethanol content of the Sandimmun Neoral formulations should also be taken into account (see section 6 Warnings and precautions).

Females and males of reproductive potential

Females

There are no special recommendations for women of child-bearing potential.

Fertility

There is limited data on the effect of ciclosporin on human fertility. No impairment in fertility was demonstrated in male and female rats up to 5mg/kg/day (below MRHD based on BSA) (see section 12 Non-clinical safety data).

9 Adverse drug reactions

Summary of the safety profile

The principal adverse drug reactions observed in clinical trials and associated with the administration of ciclosporin include renal dysfunction, tremor, hirsutism, hypertension, diarrhea, anorexia, nausea and vomiting.

Many side effects associated with ciclosporin therapy are dose-dependent and responsive to dose reduction. In the various indications the overall spectrum of side effects is essentially the same; there are, however, differences in incidence and severity. As a consequence of the higher initial doses and longer maintenance therapy required after transplantation, side effects are more frequent and usually more severe in transplant patients than in patients treated for other indications.

Anaphylactoid reactions have been observed following i.v. administration (see section 6 Warnings and precautions).

Patients receiving immunosuppressive therapies, including ciclosporin and ciclosporin-containing regimens, are at increased risk of infections (viral, bacterial, fungal, parasitic) (see section 6 Warnings and precautions). Both generalised and localised infections can occur. Pre-existing infections may also be aggravated and reactivation of Polyomavirus infections may lead to Polyomavirus associated nephropathy (PVAN) or to JC virus associated progressive multifocal leukoencephalopathy (PML). Serious and/or fatal outcomes have been reported.

Patients receiving immunosuppressive therapies, including ciclosporin and ciclosporin-containing regimens, are at increased risk of developing lymphomas or lymphoproliferative disorders and other malignancies, particularly of the skin. The frequency of malignancies increases with the intensity and duration of therapy (see section 6 Warnings and precautions). Some malignancies may be fatal.

Tabulated summary of adverse drug reactions from clinical trials

Adverse drug reactions from clinical trials (Table-1) are listed by MedDRA system organ class. Within each system organ class, the adverse drug reactions are ranked by frequency, with the most frequent reactions first. Within each frequency grouping, adverse drug reactions are presented in order of decreasing seriousness. In addition the corresponding frequency category for each adverse drug reaction is based, on the following convention (CIOMS III): very common (≥ 1/10); common (≥ 1/100, < 1/10); uncommon (≥ 1/1,000, < 1/100); rare (≥ 1/10,000, < 1/1,000) very rare (< 1/10,000), including isolated reports.

Table-1 Adverse drug reactions from clinical trials

Blood and lymphatic system disorders	
Common	Leucopenia.
Metabolism and nutrition disorders	
Very common	Anorexia; hyperglycemia
Nervous system disorders	
Very common	Tremor; headache
Common	Convulsions; paraesthesia
Vascular disorders	
Very common	Hypertension (see section 6 Warnings and precautions)
Common	Flushing
Gastrointestinal disorders	
Very common	Nausea; vomiting; abdominal discomfort; diarrhea; gingival hyperplasia
Common	Peptic ulcer
Hepatobiliary disorders	
Common	Hepatotoxicity (see section 6 Warnings and precautions)
Skin and subcutaneous tissue disorders	
Very common	Hirsutism
Common	Acne; rash
Renal and urinary disorders	
Very common	Renal dysfunction (see section 6 Warnings and precautions)
Reproductive system and breast disorders	
Rare	Menstrual disturbances
General disorders and administration site conditions	
Common	Pyrexia; edema

Adverse drug reactions from post-marketing experience (frequency not known)

The following adverse drug reactions have been derived from post-marketing experience with Sandimmun Neoral or Sandimmun via spontaneous case reports and literature cases. Because these reactions are reported voluntarily from a population of uncertain size, it is not possible to reliably estimate their frequency which is therefore categorized as not known. Adverse drugs reactions are listed according to system organ classes in MedDRA. Within each organ class, ADRs are presented below in Table-2 in order of decreasing seriousness.

Table-2	Adverse drug reactions from spontaneous reports and literature (frequency not known)
Blood and lymphatic system disorders	
Thrombotic microangiopathy, hemolytic uremic syndrome; thrombotic thrombocytopenic purpura; anaemia; thrombocytopenia.	
Metabolism and nutrition disorders	
Hyperlipidemia; hyperuricemia; hyperkalemia; hypomagnesemia.	
Nervous system disorders	
Encephalopathy including Posterior Reversible Encephalopathy Syndrome (PRES), signs and symptoms such as convulsions, confusion, disorientation, decreased responsiveness, agitation, insomnia, visual disturbances, cortical blindness, coma, paresis, cerebellar ataxia; optic disc edema including papilledema, with possible visual impairment secondary to benign intracranial hypertension;peripheral neuropathy; migraine.	
Gastrointestinal disorders	
Pancreatitis acute.	
Hepatobiliary disorders	
Hepatotoxicity and liver injury including cholestasis, jaundice, hepatitis and liver failure with some fatal outcome (see section 6 Warnings and precautions).	
Skin and subcutaneous tissue disorders	
Hypertrichosis.	
Musculoskeletal and connective tissue disorders	
Myopathy; muscle spasm; myalgia; muscular weakness, pain of lower extremities.	
Reproductive system and breast disorders	
Gynecomastia.	
General disorders and administration site conditions	
Fatigue; weight increase.	

Description of selected adverse drug reactions

Hepatotoxicity and liver injury

There have been solicited and spontaneous postmarketing reports of hepatotoxicity and liver injury including cholestasis, jaundice, hepatitis and liver failure in patients treated with ciclosporin. Most reports included patients with significant co-morbidities, underlying conditions and other confounding factors including infectious complications and co-medications with hepatotoxic potential. In some cases, mainly in transplant patients, fatal outcomes have been reported (see section 6 Warnings and precautions).

Acute and chronic nephrotoxicity

Patients receiving calcineurin inhibitors (CNIs) therapies, including ciclosporin and ciclosporin-containing regimens, are at increased risk of acute or chronic nephrotoxicity. There have been reports from clinical trials and from the post marketing setting associated with the use of ciclosporin. Cases of acute nephrotoxicity reported disorders of ion homestasis, such as hyperkalemia, hypomagnesemia, hyperuricemia which developed in the majority of the cases within the first month of treatment. Cases reporting chronic morphological changes included arteriolar hyalinosis, tubular atrophy and interstitial fibrosis (see section 6 Warnings and precautions).

Pain of lower extremities

Isolated cases of pain of lower extremities have been reported in association with ciclosporin. Pain of lower extremities has also been noted as part of Calcineurin-Inhibitor Induced Pain Syndrome (CIPS) as described in the literature.

10 Overdosage

The oral LD_{50} of ciclosporin is 2,329 mg/kg in mice, 1,480 mg/kg in rats and > 1,000 mg/kg in rabbits. The i.v. LD_{50} is 148 mg/kg in mice, 104 mg/kg in rats, and 46 mg/kg in rabbits.

Symptoms

Experience with acute overdosage of ciclosporin is limited. Oral doses of ciclosporin of up to 10 g (about 150 mg/kg) have been tolerated with relatively minor clinical consequences, such as vomiting, drowsiness, headache, tachycardia and, in a few patients, moderately severe, reversible impairment of renal function. However, serious symptoms of intoxication have been reported following accidental parenteral overdosage with ciclosporin in premature neonates.

Treatment

In all cases of overdosage, general supportive measures should be followed and symptomatic treatment applied. Forced emesis and gastric lavage may be of value within the first few hours after oral intake. Ciclosporin is not dialysable to any great extent, nor is it well cleared by charcoal haemoperfusion.

11 Clinical Pharmacology

Pharmacotherapeutic group, ATC

Pharmacotherapeutic group: Immunosuppressive agents, calcineurin inhibitors (ATC code: L04A D01).

Mechanism of action (MOA)/ Pharmacodynamics (PD)

Ciclosporin (also known as ciclosporin A) is a cyclic polypeptide consisting of 11 amino acids. It is a potent immunosuppressive agent, which in animals prolongs survival of allogeneic transplants of skin, heart, kidney, pancreas, bone marrow, small intestine or lung. Studies suggest that ciclosporin inhibits the development of cell-mediated reactions, including allograft immunity, delayed cutaneous hypersensitivity, experimental allergic encephalomyelitis, Freund's adjuvant arthritis, graft-versus-host disease (GVHD), and also T-cell dependent antibody production. At the cellular level it inhibits production and release of lymphokines including interleukin 2 (T-cell growth factor, TCGF). Ciclosporin appears to block the resting lymphocytes in the G_0 or G_1 phase of the cell cycle, and inhibits the antigen-triggered release of lymphokines by activated T-cells.

All available evidence suggests that ciclosporin acts specifically and reversibly on lymphocytes. Unlike cytostatic agents, it does not depress haemopoiesis and has no effect on the function of phagocytic cells. Patients treated with ciclosporin are less prone to infection than those receiving other immunosuppressive therapy.

Successful solid organ and bone marrow transplantations have been performed in man using ciclosporin to prevent and treat rejection and GVHD. Ciclosporin has been used

successfully both in Hepatitis C Virus (HCV) positive and HCV negative liver transplants recipients. Beneficial effects of Sandimmun therapy have also been shown in a variety of conditions that are known, or may be considered to be of autoimmune origin.

Pharmacokinetics (PK)

When Sandimmun Neoral is given, it provides improved dose linearity in ciclosporin exposure (AUC_B), a more consistent absorption profile, and less influence from concomitant food intake and from diurnal rhythm than does Sandimmun. These properties combined yield a lower within-patient variability in pharmacokinetics of ciclosporin, and a stronger correlation between trough concentration and total exposure (AUC_B). As a consequence of these additional advantages, the time schedule of Sandimmun Neoral administration need no longer take that of meals into account. In addition, Sandimmun Neoral produces a more uniform exposure to ciclosporin throughout the day, and from day to day on a maintenance regimen.

Sandimmun Neoral soft gelatine capsules and Sandimmun Neoral oral solution are bioequivalent. The data available indicate that following a 1:1 conversion from Sandimmun to Sandimmun Neoral, trough concentrations in whole blood are comparable, thereby remaining in the desired therapeutic trough level range. Compared to Sandimmun (with which peak blood concentrations are achieved within 1-6 hours), Sandimmun Neoral is more quickly absorbed (resulting in a 1 hour earlier mean t_{max} and a 59% higher mean C_{max}), and exhibits, on average, a 29% higher bioavailability.

Ciclosporin is distributed largely outside the blood volume. In the blood, 33-47% is present in plasma, 4-9% in lymphocytes, 5-12% in granulocytes, and 41-58% in erythrocytes. In plasma, approximately 90% is bound to proteins, mostly lipoproteins.

Ciclosporin is extensively biotransformed to approximately 15 metabolites. There is no single major metabolic pathway. Elimination is primarily biliary, with only 6% of the oral dose excreted in the urine; only 0.1% is excreted in the urine as unchanged drug.

There is a high variability in the data reported on the terminal half-life of ciclosporin depending on the assay applied and on the target population. The terminal half-life ranged from 6.3 hours in healthy volunteers to 20.4 hours in patients with severe liver disease (see section 6 Warnings and precautions).

12 Non-clinical safety data

Carcinogenicity studies were carried out in male and female rats and mice. In the 78-week mouse study, at doses of 1, 4, and 16 mg/kg per day, evidence of a statistically significant trend was found for lymphocytic lymphomas in females, and the incidence of hepatocellular carcinomas in mid-dose males significantly exceeded the control value. In the 24-month rat study conducted at 0.5, 2, and 8 mg/kg per day, pancreatic islet cell adenomas significantly exceeded the control rate at the low dose level. The hepatocellular carcinomas and pancreatic islet cell adenomas were not dose related.

Ciclosporin has not been found mutagenic/genotoxic in the Ames test, the v79–hgprt test, the micronucleus test in mice and Chinese hamsters, the chromosome-aberration tests in Chinese hamster bone marrow, the mouse dominant lethal assay, and the DNA repair test in sperm from treated mice. A study analyzing sister chromatid exchange (SCE) induction by ciclosporin using human lymphocytes *in vitro* gave indication of a positive effect (i.e. induction of SCE) at high concentrations in this system.

An increased incidence of malignancy is a recognized complication of immunosuppression in recipients of organ transplants. The most common forms of

neoplasms are non-Hodgkin's lymphoma and carcinomas of the skin. The risk of malignancies during ciclosporin treatment is higher than in the normal, healthy population, but similar to that in patients receiving other immunosuppressive therapies. It has been reported that reduction or discontinuance of immunosuppression may cause the lesions to regress.

In a fertility study in rats, increased perinatal mortality and impaired postnatal development of F1 pups were observed at 15 mg/kg/day (below the MRHD based on BSA). No adverse effects on fertility and reproduction were observed up to 5 mg/kg/day (below the MRHD based on BSA) in male and female rats.For reproductive toxicity, see Section 8 Pregnancy, lactation, females and males of reproductive potential.

13 Pharmaceutical information

Incompatibilities

Sandimmun concentrate for solution for infusion* contains polyoxyl castor oil, which can cause phthalate stripping from PVC. If available, glass containers should be used for infusion. Plastic bottles should be used only if they conform to the requirements for 'Sterile plastic containers for human blood and blood components' respectively to 'Empty sterile containers of plasticised poly(vinyl chloride) for human blood and blood components' of the current European Pharmacopoeia. Containers and stoppers should be free of silicone oil and fatty substances.

Shelf life

The expiry date is indicated on the packaging.

Special precautions for storage

Sandimmun Neoral capsules may be stored at room temperature not exceeding 30°C. Occasional increases in temperatures up to 30°C do not affect the quality of the product.

Sandimmun Neoral capsules should be left in the blister pack until required for use. When a blister is opened, a characteristic smell is noticeable. This is normal and does not mean that there is anything wrong with the capsule.

Sandimmun concentrate for solution for infusion*. Do not store above 30°C.

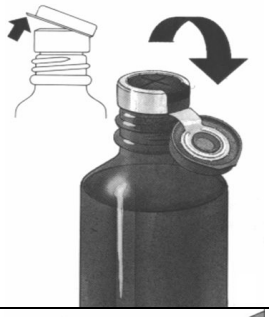
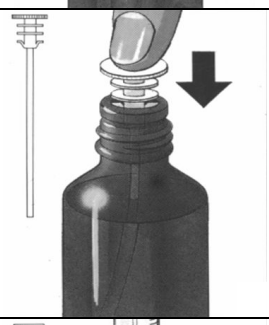
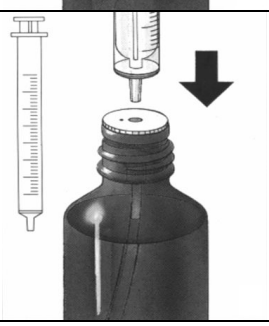
Sandimmun Neoral should be kept out of the reach and sight of children.

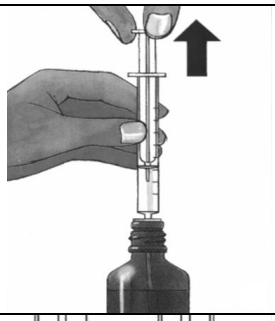
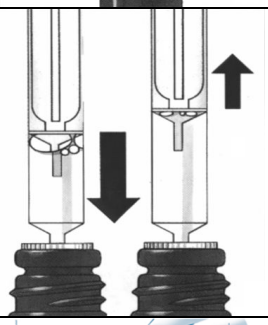
Nature and contents of container

Sandimmun Neoral soft gelatine capsules: Blister packs of double-sided aluminium.

Sandimmun concentrate for solution for infusion*: 1 mL and 5 mL uncoloured glass ampoules.

Initial use of Sandimmun concentrate for solution for infusion*

1.	Raise the plastic flap	
2.	Tear off the sealing cap completely.	
3.	Remove black stopper and throw away.	
4.	Push tube unit firmly into the neck of the bottle.	
5.	Insert syringe into stopper.	

6.	Draw up prescribed volume of solution.	
7.	Should there be any large bubbles in the syringe,	
8.	Push the plunger down and withdraw again a few times to force the bubbles out. Once large bubbles are out of the tube, draw up the prescribed volume of solution again. A few tiny bubbles remaining do not matter and will not cause the prescribed dose to be ineffective.	
9.	After use, wipe only the outside of the syringe with a dry tissue and replace it in the case. The white stopper and tube should remain in bottle. Close bottle with cap provided.	

Packing

Sandimmun® Neoral soft capsule:

25 mg: Box, 10 blisters @ 5 capsules	Reg. No. DKI1921001202A1
50 mg: Box, 10 blisters @ 5 capsules	Reg. No. DKI1921001202B1
100 mg: Box, 10 blisters @ 5 capsules	Reg. No. DKI1921001202C1

HARUS DENGAN RESEP DOKTER

To be dispensed only on the prescription of a physician

Sandimmun® Neoral soft capsule 25 mg, 50 mg & 100 mg

Manufactured by Catalent Germany Eberbach GmbH, Eberbach, Germany for Novartis Pharma AG, Basel, Switzerland.

Packed by Lek Pharmaceuticals d.d., Lendava, Slovenia.

Imported by PT Novartis Indonesia, Jakarta, Indonesia

Disclaimer: Sandimmun neoral oral solution and Sandimmun concentrate for solution for infusion is not registered or marketed in Indonesia.

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