

TEMODAL Powder for Injection

NAME OF MEDICINE

TEMODAL

Temozolomide 100 mg per vial powder for injection for infusion

PRESENTATION

Each TEMODAL vial contains 100 mg of temozolomide lyophilized powder, mannitol, L-threonine, polysorbate-80, sodium citrate dihydrate, and hydrochloric acid.

Temozolomide is imidazol[5,1-*d*]-1,2,3,5-tetrazine-8-carboxamide,3,4-dihydro-3-methyl-4-oxo.

It has CAS Registry Number: 85622-93-1; Molecular Formula: C₆H₈N₆O₂; MW: 194.15

USES

Actions

TEMODAL is an imidazotetrazine alkylating agent with antitumour activity. It undergoes rapid chemical conversion in the systemic circulation at physiological pH to the active compound, monomethyl triazeno imidazole carboxamide (MTIC). The cytotoxicity of MTIC is thought to be due primarily to alkylation at the O⁶ position of guanine with additional alkylation also occurring at the N⁷ position. Cytotoxic lesions that develop subsequently are thought to involve aberrant repair of the methyl adduct.

Preclinical Toxicology

The preclinical toxicology profile of temozolomide for intravenous administration is comparable to that of the oral (capsule) formulation. While the intravenous formulation produced local irritation at the site of injection in both rabbits and rats, the irritation was transient

Single-dose toxicity studies of TEMODAL were conducted in mice, rats and dogs. Estimated LD₅₀ doses by the oral route were moderately higher in the rat (approximately 1900 mg/m²) than in the mouse (approximately 1000 mg/m²). The minimum lethal dose in dogs was 600 mg/m². In the single-dose studies, clinical signs of toxicity and death were generally delayed, reflecting a delayed toxicity to tissues that normally proliferate more rapidly resulting in general deterioration of organ function; toxicity is consistent with that expected of an alkylating agent.

TEMODAL is rapidly absorbed following oral administration. Systemic exposure at the therapeutic dose level in humans is similar to that of the rat and dog.

Single-cycle (5-day dosing, 23 days non-treatment), three- and six-cycle toxicity studies were conducted in rats and dogs. In multiple-cycle studies, the primary targets of toxicity included bone marrow, lymphoreticular system, testes and gastrointestinal tract. TEMODAL is more toxic to the rat and dog than to humans, as the therapeutic dose regimen (200 mg/m²), which has been well tolerated in humans, approximates the minimum lethal dose following multiple doses in both rats and dogs. Dose-related reductions in leukocytes and platelets appear to be sensitive indicators of toxicity in both rats and dogs. During intervals when dosing is discontinued, significant evidence of recovery from most haematological, biochemical and histopathological changes occurs.

Pharmacokinetics

In an open-label, fixed-sequence, crossover (within period) study of the pharmacokinetics of oral and intravenous temozolomide in patients with primary CNS malignancies, TEMODAL Powder for Injection was administered over 90 minutes and was found to be bioequivalent for C_{max} and AUC of temozolomide and MTIC as compared to TEMODAL capsules, following administration of 150 mg/m² dose. Mean C_{max} values for temozolomide and MTIC were 7.4 µg/ml and 320 ng/ml, respectively, following 90 minute intravenous infusion. Mean AUC(I) values for temozolomide and MTIC were 25 µg•hr/mL and 1,004 ng•hr/mL, respectively.

Preclinical data suggest that TEMODAL crosses the blood-brain barrier rapidly and is present in the cerebrospinal fluid. After oral administration to adult patients, TEMODAL is absorbed rapidly with peak concentrations reached as early as 20 minutes post-dose (mean times between 0.5 and 1.5 hours). Plasma concentrations increase in a dose-related manner. Plasma clearance, volume of distribution and half-life are independent of dose. TEMODAL demonstrates low protein binding (10% to 20%), and thus is not expected to interact with highly protein bound agents. After oral administration of ¹⁴C-labelled TEMODAL, mean faecal excretion of ¹⁴C over 7 days post-dose was 0.8% indicating complete absorption. Following oral administration approximately 5% to 10% of the dose is recovered unchanged in the urine over 24 hours, and the remainder excreted as AIC (4-amino-5-imidazole-carboxamide hydrochloride) or unidentified polar metabolites. The bioavailability of TEMODAL is approximately 100%.

Analysis of population-based pharmacokinetics of TEMODAL revealed that plasma TEMODAL clearance was independent of age, renal function, hepatic function or tobacco use.

Paediatric patients had a higher AUC than adult patients; however, the maximum tolerated dose (MTD) was 1000 mg/m² per cycle both in children and in adults.

INDICATIONS

TEMODAL is indicated for the treatment of

- patients with newly diagnosed glioblastoma multiforme concomitantly with radiotherapy and then as adjuvant treatment.
- patients with recurrent high grade glioma, such as glioblastoma multiforme or anaplastic astrocytoma.

TEMODAL is also indicated as first line treatment for patients with advanced metastatic malignant melanoma.

DOSAGE AND ADMINISTRATION

Anti-emetic therapy may be administered prior to or following administration of TEMODAL.

Each vial of TEMODAL Powder for Injection contains temozolomide lyophilized powder. When reconstituted with 41 mL Sterile Water for Injection, the resulting solution will contain 2.5 mg/mL temozolomide. The vials should be gently swirled and not shaken.

Vials should be inspected and any vial containing visible particulate matter should not be used. To reduce microbiological hazard use as soon as practicable after reconstitution. If storage is necessary, hold at 2°C to 8°C for not more than 14 hours. The solution should be used within 14 hours including infusion time.

Using aseptic technique, withdraw up to 40 mL from each vial to make up the total dose and transfer into an empty 250 mL infusion bag. TEMODAL Powder for Injection should be infused intravenously using a pump over a period of not less than 90 minutes. TEMODAL Powder for Injection should be administered only by intravenous infusion. Product is for single use in one patient only, and any remaining solution should be discarded.

TEMODAL Powder for Injection may be administered in the same IV line with 0.9% Sodium Chloride injection. It is incompatible with dextrose solutions.

Because no data are available on the compatibility of TEMODAL Powder for Injection with other intravenous substances or additives, other medications should not be infused simultaneously through the same intravenous line.

Adults: Newly diagnosed glioblastoma multiforme

Concomitant phase

Concomitant phase consists of TEMODAL administered orally at 75 mg/m² daily for 42 days with focal radiotherapy (60 Gy administered in 30 fractions). The concomitant phase is followed by the adjuvant phase [TEMODAL for 6 cycles.]

Dose reductions are not recommended, however, dose interruptions may occur based on patient tolerance.

The TEMODAL dose can be continued throughout the 42 day concomitant period up to 49 days (if needed due to radiotherapy interruption) if all of the following conditions are met: absolute neutrophil count $\geq 1.5 \times 10^9 / L$ thrombocyte count $\geq 100 \times 10^9 / L$ common toxicity criteria (CTC) non-haematological toxicity \leq Grade 1 (except for alopecia, nausea and vomiting).

During concomitant treatment a complete blood count should be obtained weekly. TEMODAL dosing should be interrupted or discontinued during concomitant phase according to the haematological and non-haematological toxicity criteria as noted in Table 1.

Table 1 TEMODAL Dosing Interruption or Discontinuation During Concomitant Focal Radiotherapy and TEMODAL

Toxicity	TMZ Interruption ^a	TMZ Discontinuation
Absolute Neutrophil Count	≥ 0.5 and $<1.5 \times 10^9 / L$	$<0.5 \times 10^9 / L$
Thrombocyte Count	≥ 10 and $<100 \times 10^9 / L$	$<10 \times 10^9 / L$
CTC Non-haematological Toxicity(except for alopecia, nausea, vomiting)	CTC Grade 2	CTC Grade 3 or 4
^a : Treatment with concomitant TMZ could be continued when all of the following conditions were met: absolute neutrophil count $\geq 1.5 \times 10^9 / L$; thrombocyte count $\geq 100 \times 10^9 / L$; CTC non-haematological toxicity \leq Grade 1 (except for alopecia, nausea, vomiting). TMZ= TEMODAL; CTC = Common Toxicity Criteria.		

Adjuvant Phase

Four weeks after completing the TEMODAL + Radiotherapy phase, TEMODAL is administered for an additional 6 cycles of adjuvant treatment. Dosage in Cycle 1 (adjuvant) is 150 mg/m²

once daily for 5 days followed by 23 days without treatment. At the start of Cycle 2, the dose is escalated to 200 mg/m² if the CTC non-haematological toxicity for Cycle 1 is Grade ≤ 2 (except for alopecia, nausea and vomiting), absolute neutrophil count (ANC) is ≥1.5x10⁹/L, and the thrombocyte count is ≥100x10⁹/L. If the dose was not escalated at Cycle 2, escalation should not be done in subsequent cycles. The dose remains at 200 mg/m² per day for the first 5 days of each subsequent cycle except if toxicity occurs. During treatment a complete blood count should be obtained on day 22 (21 days after the first dose of TEMODAL). The TEMODAL dose should be reduced or discontinued according to Table 3. Dose reductions during the adjuvant phase should be applied according to Tables 2 and 3.

Table 2 TEMODAL Dose Levels for Adjuvant Treatment

Dose Level	Dose (mg/m ² /day)	Remarks
-1	100	Reduction for prior toxicity
0	150	Dose during Cycle 1
1	200	Dose during Cycles 2-6 in absence of toxicity

Table 3 TEMODAL Dose Reduction or Discontinuation During Adjuvant Treatment

Toxicity	Reduce TMZ by 1 Dose Level ^a	Discontinue TMZ
Absolute Neutrophil Count	< 1.0 x 10 ⁹ /L	See footnote b
Thrombocyte Count	< 50 x 10 ⁹ /L	See footnote b
CTC Non-haematological Toxicity (except for alopecia, nausea, vomiting)	CTC Grade 3	CTC Grade 4 ^b

^a: TMZ dose levels are listed in Table 2
^b: TMZ is to be discontinued if dose reduction to < 100 mg/m² is required or if the same Grade 3 non-haematological toxicity (except for alopecia, nausea, vomiting) recurs after dose reduction.
 TMZ+ TEMODAL, CTC= Common Toxicity Criteria.

Adults: Recurrent glioblastoma multiforme, anaplastic astrocytoma or malignant melanoma

In patients previously untreated with chemotherapy, TEMODAL is administered orally at a dose of 200 mg/m² once daily for 5 days per 28-day cycle. In patients previously treated with chemotherapy, the initial dose is 150 mg/m² once daily, to be increased in the second cycle to 200 mg/m² daily providing the absolute neutrophil count (ANC) is ≥1.5x10⁹/L and the thrombocyte count is ≥100x10⁹/L on Day 1 of the next cycle. Dose modifications for TEMODAL should be based on toxicities according to nadir ANC or platelet counts.

Children

In patients 3 years of age and older, TEMODAL is administered orally at a dose of 200 mg/m² once daily for 5 days per 28-day cycle. Paediatric patients previously treated with chemotherapy or cranio-spinal irradiation should receive an initial dose of 150 mg/m² once daily for 5 days, with escalation to 200 mg/m² once daily at the next cycle if there is no haematologic toxicity.

Laboratory Parameters for does modification in recurrent or progressive malignant glioma or malignant melanoma

Prior to dosing, the following laboratory parameters must be met: absolute neutrophil count (ANC) $\geq 1.5 \times 10^9/L$ and platelets $\geq 100 \times 10^9/L$. During cyclical treatment a complete blood count must be obtained on Day 22 (21 days after the first dose) or within 48 hours of that day, and weekly until ANC is above $1.5 \times 10^9/L$ and platelet count exceeds $100 \times 10^9/L$. If ANC falls to $< 1.0 \times 10^9/L$ or the platelet count is $< 50 \times 10^9/L$ during any cycle, the next cycle should be reduced one dose level. Dose levels include 100 mg/m^2 , 150 mg/m^2 and 200 mg/m^2 . The lowest recommended dose is 100 mg/m^2 .

The efficacy of temozolomide for the treatment of recurrent glioblastoma multiforme, in patients who received the drug as concomitant/ adjuvant treatment has not been established

In patients with recurrent glioblastoma multiforme/anaplastic astrocytoma or metastatic melanoma, TEMODAL can be continued until disease progression or for a maximum of 2 years.

CONTRAINDICATIONS

TEMODAL is contraindicated in patients who have a history of hypersensitivity reaction to temozolomide, its components or to dacarbazine (DTIC).

TEMODAL is contraindicated for use during pregnancy (see "Use in Pregnancy").

TEMODAL must not be used by breastfeeding women (see Use in Lactation).

TEMODAL is contraindicated in patients with severe myelosuppression.

WARNINGS AND PRECAUTIONS

Patients who received concomitant TEMODAL and radiotherapy in a pilot trial for the prolonged 42 day schedule were shown to be at particular risk for developing *Pneumocystis carinii pneumonia*.

Thus, prophylaxis against *Pneumocystis carinii pneumonia* is required for all patients receiving concomitant TEMODAL and radiotherapy for the 42 day regimen (with a maximum of 49 days) regardless of lymphocyte count. If lymphocytopenia occurs *Pneumocystis carinii pneumonia* prophylaxis should continue to a lymphocyte count less than or equal to grade 1.

There may be a higher occurrence of PCP when temozolomide is administered during a longer dosing regimen. However, all patients receiving temozolomide, particularly patients receiving steroids should be observed closely for the development of PCP regardless of the regimen.

Antiemetic therapy

Nausea and vomiting are very commonly associated with TEMODAL and guidelines are provided:

Patients with newly diagnosed glioblastoma multiforme:

- anti-emetic prophylaxis is recommended prior to the initial dose of concomitant TEMODAL
- anti-emetic prophylaxis is strongly recommended during the adjuvant phase.

Patients with recurrent glioma: Patients who have experienced severe (Grade 3 or 4) vomiting in previous treatment cycles may require anti-emetic therapy.

All Patients

Keep this medication out of the reach of children.

The ability to drive and use machinery may be impaired in patients treated with TEMODAL due to fatigue and somnolence.

Use in Patients with Hepatic or Renal Dysfunction

The pharmacokinetics of temozolomide were comparable in patients with normal hepatic function and in those with mild or moderate hepatic dysfunction. No data are available on the administration of TEMODAL in patients with severe hepatic dysfunction (Child's Class III) or with renal dysfunction. Based on the pharmacokinetic properties of temozolomide, it is unlikely that dose reductions are required in patients with severe hepatic or renal dysfunction. However, caution should be exercised when TEMODAL is administered in these patients.

Use in Children

There is no clinical experience with the use of TEMODAL in children under the age of 3 years with glioblastoma multiforme. There is limited experience in children over the age of 3 years with glioma.

There is no clinical experience in melanoma patients under the age of 18 years.

Use in Elderly Patients

Elderly patients (>70 years of age) appear to be at increased risk of neutropenia and thrombocytopenia, compared with younger patients.

Carcinogenicity, Mutagenicity and Impairment of Fertility

No long term carcinogenicity studies have been conducted, but evidence of carcinogenic potential of TEMODAL was observed in the three- and six-cycle studies in rats. Neoplasms observed in the rat studies included mammary carcinoma, keratoacanthoma of the skin, basal cell adenoma and a variety of mesenchymal neoplasms. These neoplasms occurred at systemic exposure to temozolomide less than that anticipated clinically. No tumours or preneoplastic changes were observed in the dog studies of up to six cycles. Considering that TEMODAL is a prodrug of the alkylating agent MTIC, its tumourigenic potential is not unexpected and has been observed with other alkylating agents, including those producing MTIC.

Temozolomide was genotoxic in assays for gene mutations (*Salmonella typhimurium* and *Eschericia coli*) and chromosomal changes (human blood lymphocytes).

Pathological lesions of necrosis, degeneration, hypospermatogenesis and presence of syncytial cells and immature/abnormal spermatozoa in the testes, epididymis and seminal vesicles have been observed in the mouse, rat and dog at systemic exposure levels to temozolomide well within the anticipated human exposure. Decreased ovarian weight was noted in rats at temozolomide exposure comparable to that anticipated clinically. The reversibility of these changes has not been investigated, but no evidence of recovery was noted during the 23-day nontreatment period.

TEMODAL is contraindicated in women who intend to become pregnant, and effective contraception should be used in both male and female patients during and for a prolonged period after treatment with temozolomide (see Contraindications, Use in Pregnancy and Use in Men).

Use in Pregnancy (Category D)

There are no studies in pregnant women. In preclinical studies in rats and rabbits administered 150 mg/m², teratogenicity and/or foetal toxicity were demonstrated. TEMODAL, therefore, should not be administered to pregnant women. If use during pregnancy must be considered, the patient should be apprised of the potential risk to the foetus. Women of childbearing potential should be advised to avoid pregnancy while they are receiving TEMODAL and for the 6 months after discontinuation of TEMODAL therapy.

Use in Lactation

It is not known whether temozolomide is excreted in human milk; thus, TEMODAL should not be used by women who are breast-feeding.

Use in Men

Effective contraception should be used by male patients treated with TEMODAL. Temozolomide can have genotoxic effects. Therefore, men being treated with temozolomide are advised not to father a child and to seek advice on cryoconservation of spermatozoa prior to treatment because of the possibility of irreversible infertility due to therapy with temozolomide (see Carcinogenicity, Mutagenicity and Impairment of Fertility).

ADVERSE EFFECTS

Newly diagnosed glioblastoma multiforme

Table 4: Treatment Emergent Adverse Events with an incidence of 2% or greater observed more frequently in the TMZ arm than the RT arm during the concomitant phase and corresponding adverse events in the adjuvant phase.

Table 4 Adverse event	Concomitant phase		Adjuvant phase
	Radiotherapy Alone concomitant n=285 (%)	RT+TMZ concomitant n=288 (%)	TMZ Adjuvant Therapy n=224 (%)
Musculoskeletal and connective tissue disorders			
muscle weakness	1	3	3
arthralgia	1	2	6
Nervous system disorders			
headache	17	19	23
neuropathy	2	3	3
aphasia	1	3	2
concentration impaired	1	2	3
paresthesia	1	2	2
balance impaired NOS	1	2	2
consciousness decrease	<1	2	<1
somnolence	<1	2	2
General disorders and administration site conditions			
fatigue	49	54	61
radiation injury NOS	4	7	2
fever	1	4	4
allergic reaction	2	5	3
taste perversion	2	6	5
face oedema	1	3	1
pain	1	2	2
Ear and labyrinth disorders			
hearing impairment	1	3	4
Gastrointestinal disorders			
nausea	16	36	49
constipation	6	18	22
dyspepsia	2	3	2
diarrhoea	3	6	10
stomatitis	5	7	9
abdominal pain	1	2	5
dysphagia	1	2	3
Vascular disorders			
oedema legs	1	2	2
haemorrhage NOS	<1	2	3
Renal and urinary disorders			
micturition frequency	1	2	<1
urinary incontinence	1	2	2
Blood and the lymphatic system			
thrombocytopenia	1	4	8
lymphopenia	0	2	1
leucopenia	0	2	2
neutropenia	0	2	3
Metabolism and nutrition disorders			
anorexia	9	19	27
vomiting	6	20	29
weight decrease	<1	2	3
hyperglycaemia	1	2	1
Skin and subcutaneous tissue disorders			
alopecia	63	69	55
rash	15	19	13
pruritus	1	4	5
Psychiatric disorders			
insomnia	3	5	4
Respiratory, thoracic and mediastinal			
Dyspnoea	3	4	5
coughing	1	5	8
Investigation			
SGPT increased	2	4	2

Patients with recurrent anaplastic astrocytoma , glioblastoma multiforme or malignant melanoma

Table 5: Frequency of adverse drug reactions reported in clinical trials or spontaneously, classified according to body system

Adverse Effects in patients with recurrent anaplastic astrocytoma, glioblastoma multiforme or malignant melanoma	
Very Common (≥10%); Common (≥1% and <10%)	
Neurological Very common Common	Fatigue, headache Somnolence, asthenia, dizziness, paresthesia
Gastrointestinal Very common Common	Nausea, vomiting, constipation, anorexia Diarrhoea, abdominal pain, dyspepsia, taste perversion
Haematological Very Common Common	Thrombocytopenia, neutropenia Anemia, leucopenia
Dermatological Common	Rash, alopecia, pruritus, petechiae
Respiratory Common	Dyspnoea
General Common	Fever, pain, malaise, weight decrease, rigors

In clinical trials, the most frequently occurring undesirable effects were gastrointestinal disturbances, specifically nausea (42%) and vomiting (35%). These effects were usually Grade 1 or 2 (mild to moderate in severity) and were either self-limiting or readily controlled with standard anti-emetic therapy. The incidence of severe nausea and vomiting was 4%. There is no information on the risk of second malignancies. Severe myelosuppression, predominantly thrombocytopenia, was dose-limiting and occurred in 7% of all patients. Anaemia was reported in 5% of patients. Severe neutropenia and leucopenia occurred in 3% and 2% of patients, respectively.

Laboratory Results

Grade 3 or 4 thrombocytopenia and neutropenia occurred in 19% and 17% of patients respectively treated for glioma and 20% and 22% respectively of patients with metastatic melanoma. This led to hospitalisation and/or discontinuation of TEMODAL in 8% and 4% respectively of patients with glioma and 3% and 1.3% respectively of those with melanoma. Myelosuppression was predictable (usually within the first few cycles, with the nadir between Day 21 and 28), and recovery was rapid, usually within 1-2 weeks. No evidence of cumulative myelosuppression was observed. Pancytopenia, leucopenia and anaemia have also been reported. Lymphopenia has also been reported very commonly.

In a population pharmacokinetics analysis of clinical trial experience there were 101 female and 169 male subjects for whom nadir neutrophil counts were available and 110 female and 174 male subjects for whom nadir platelet counts were available. There were higher rates of Grade 4 neutropenia (ANC <500 cells/ μ L), 12% versus 5%, and thrombocytopenia (<20,000 cells/ μ L), 9% versus 3%, in women vs. men in the first cycle of therapy. In a 400-subject recurrent glioma data set, Grade 4 neutropenia occurred in 8% of female versus 4% of male subjects and Grade 4 thrombocytopenia in 8% of female vs. 3% of male subjects in the first cycle of therapy. In a study of 288 subjects with newly diagnosed glioblastoma multiforme, Grade 4 neutropenia occurred in 3% of female vs 0% of male subjects and Grade 4 thrombocytopenia in 1% of female vs 0% of male subjects in the first cycle of therapy.

Patients treated with TEMODAL Powder for Injection

TEMODAL Powder for Injection delivers equivalent temozolomide dose and exposure to both temozolomide and MTIC as the corresponding TEMODAL capsules. Adverse events probably related to treatment that were reported from the two studies with the IV formulation (n=35) that were not reported in studies using the TEMODAL capsules were those at the infusion site: pain, irritation, pruritus, warmth, swelling, and erythema at infusion site; as well as haematoma.

Post-Marketing experience with TEMODAL

During the marketing of TEMODAL, allergic reactions, including anaphylaxis, have been reported very rarely. Very rare cases of erythema multiforme, toxic epidermal necrolysis and Stevens-Johnson syndrome have also been reported. Rarely, cases of opportunistic infections including *Pneumocystis carinii pneumonia* (PCP) have been reported. Cases of interstitial pneumonitis/pneumonitis have been reported very rarely.

Very rare cases of myelodysplastic syndrome (MDS) and secondary malignancies, including myeloid leukaemia, have been reported in patients treated with regimens that included TEMODAL. Prolonged pancytopenia, which may result in aplastic anaemia has been reported very rarely.

DRUG INTERACTIONS

Administration of TEMODAL with ranitidine did not result in clinically significant alterations in the extent of absorption of TEMODAL. Co-administration of dexamethasone, prochlorperazine, phenytoin, carbamazepine, ondansetron, H₂-receptor antagonists or phenobarbital did not alter the clearance of TEMODAL. Co-administration with valproic acid was associated with a small but statistically significant decrease in clearance of temozolomide.

Use of TEMODAL in combination with other myelosuppressive agents may increase the likelihood of myelosuppression.

OVERDOSAGE

Doses of 500, 750, 1,000, and 1,250 mg/m² (total dose per cycle over 5 days) have been evaluated clinically in patients. Dose-limiting toxicity was haematological and was reported at any dose but is expected to be more severe at higher doses. An overdose of 2,000 mg per day for 5 days was taken by one patient and the adverse events reported were pancytopenia, pyrexia, multi-organ failure and death. There are reports of patients who have taken more than 5 days of treatment (up to 64 days) with adverse events reported including bone marrow suppression, with or without infection, in some cases severe and prolonged and resulting in death. In the event of an overdose, haematologic evaluation is needed. Supportive measures should be provided as necessary.

MEDICINE CLASSIFICATION

Prescription Only Medicine

PACKAGE QUANTITIES

TEMODAL Powder for Injection is available as a single 100 mg vial.

FURTHER INFORMATION

CLINICAL TRIALS

Newly diagnosed Glioblastoma Multiforme

Five hundred and seventy-three patients were randomized to receive either TEMODAL (TMZ) + Focal Radiotherapy (RT) (n= 287) or Focal RT alone (n=286). Patients in the TEMODAL + RT arm received concomitant TEMODAL (75 mg/m²) once daily, starting the first day of RT until the last day of RT, for 42 days (with a maximum of 49 days). This was followed by adjuvant TEMODAL (150 -200 mg/m²) on day 1 -5 of every 28-day cycle for 6 cycles, starting 4 weeks after the end of RT. Patients in the control arm received RT only. Pneumocystis carinii pneumonia (PCP) prophylaxis was required during RT and combined TEMODAL therapy regardless of lymphocyte count. If lymphocytopenia occurred, Pneumocystis carinii pneumonia prophylaxis continued during RT/TMZ until lymph recovery to a lymphocyte count less than or equal to grade 1. The trial excluded patients below 18 yrs old and greater than 70yrs old and those with a WHO PS greater than 2 and who had received prior chemotherapy or radiotherapy.

TEMODAL was administered as salvage therapy in the follow-up phase in 161 patients of the 282 (57 %) in the RT alone arm, and 62 patients of the 277 (22%) in the TEMODAL + RT arm . The hazard ratio (HR) for overall survival was 1.59 (95 % CI for HR=1.33-1.91) with a log-rank p <0.0001 in favor of the TEMODAL arm. The estimated probability of surviving 2 years or more (26 % vs 10 %) was higher for the RT + TEMODAL arm. The addition of concomitant and adjuvant TEMODAL to radiotherapy in the treatment of patients with newly diagnosed GBM demonstrated a statistically significant improved overall survival compared with radiotherapy alone. (Figure 1)

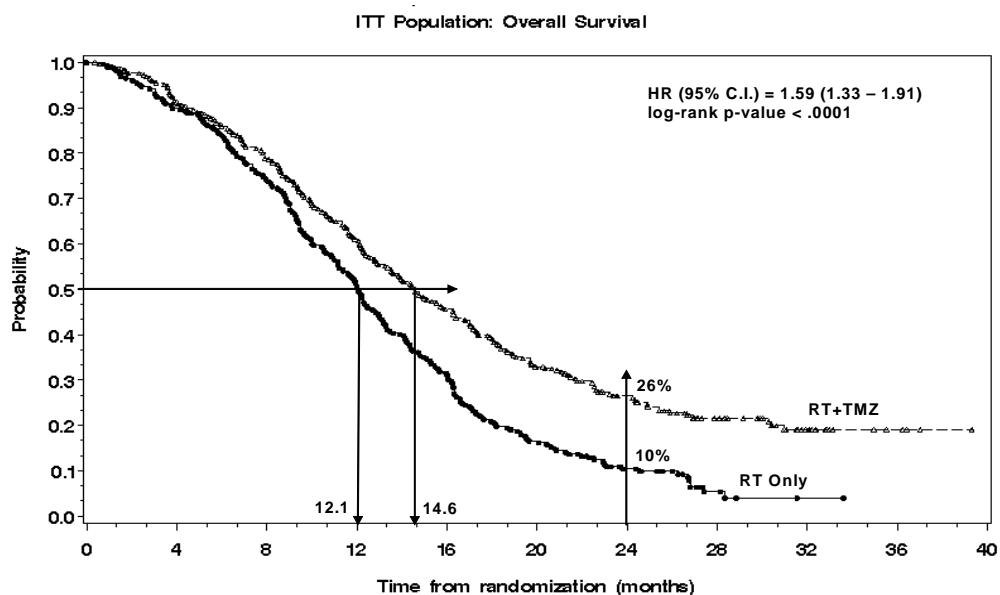


Figure 1 Kaplan-Meier Curves for Overall Survival (ITT Population; at time of randomisation; RT alone group=286 and RT/TMZ group=287)

Recurrent Glioblastoma multiforme

Data on clinical efficacy in patients with glioblastoma multiforme (Karnofsky performance status [KPS] ≥ 70), progressive or recurrent after surgery and radiotherapy, were based on two clinical trials. One was a non-comparative trial in 138 patients (29% received prior chemotherapy) and the other was a randomised reference controlled trial of TEMODAL and procarbazine in a total of 120 patients (37.5% received prior treatment with nitrosourea based chemotherapy). In both trials, the primary endpoint was progression-free survival (PFS) defined by MRI scans or neurological worsening. In the non-comparative trial, the PFS at 6 months was 19%, the median progression-free survival was 2.1 months and the median overall survival was 5.4 months. The objective response rate based on MRI scans was 8%.

In the randomised trial, the 6 month PFS was significantly greater for TEMODAL (20%, 95% confidence interval, CI: 9-30%) than for procarbazine (10%, 95% CI: 2-18%) with median PFS of 3.5 and 1.9 months respectively (log rank $p = 0.015$). The median survival was 7.7 and 6.1 months for TEMODAL and procarbazine respectively (log rank $p = 0.61$). At 6 months the fraction of surviving patients was significantly higher in the TEMODAL arm (66%, 95% CI: 54-78%) compared with the procarbazine arm (51%, 95% CI: 38-64%).

The study has later been completed (225 patients) and results reinforce those of the interim report.

Anaplastic astrocytoma

In a multicentre, global, prospective phase II trial evaluating the safety and efficacy of TEMODAL in the treatment of 162 patients with anaplastic astrocytoma at first relapse (60% received prior chemotherapy), the 6 month progression-free survival was 46%. The median progression-free survival was 5.4 months and median overall survival was 14.6 months. Response rate, based on the central reviewer assessment, was 35% (13 CR and 43 PR) for the intent-to-treat population. Including 43 stable disease responses, the response rate was 61%. The 6-month event-free survival for the ITT population was 44% with a median event-free survival of 4.6 months, which was similar to the results for the progression-free survival. For the eligible histology population, the efficacy results were similar. Achieving a radiologic objective response or maintaining progression-free status was strongly associated with maintained or improved quality of life.

Metastatic melanoma

The pivotal trial involving 305 patients with advanced metastatic melanoma at first presentation of metastatic disease was a large multicentre randomised phase III trial comparing the efficacy of TEMODAL (156 patients) with the standard treatment, dacarbazine (DTIC, 149 patients). Patients were balanced in regard to demographics and disease characteristics between the two treatment groups. Patients may not have had previous treatment for metastatic melanoma and may not have had brain metastases from melanoma. The primary endpoint was overall survival. Progression-free survival and response rate were secondary endpoints.

Median overall survival was longer for patients treated with TEMODAL compared to patients treated with DTIC (7.7 vs. 6.4 months respectively, $p = 0.2$). Median progression-free survival was statistically significantly longer with TEMODAL compared to DTIC (1.9 months vs. 1.5 months respectively, $p = 0.012$). The overall response rate was 13.5% for TEMODAL and 12.1% for DTIC.

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