Nivolumab 360mg and Ipilimumab 1mg/kg Therapy

INDICATIONS FOR USE:

INDICATION	ICD10	Regimen Code	Reimbursement Status
Nivolumab in combination with ipilimumab for the first-line treatment of adult patients with unresectable malignant pleural mesothelioma	C45	00792a	ODMS 1/4/2023

TREATMENT:

The starting dose of the drugs detailed below may be adjusted downward by the prescribing clinician, using their independent medical judgement, to consider each patients individual clinical circumstances.

Nivolumab is administered every 3 weeks on Day 1 and Day 22. Ipilimumab is administered on Day 1 only. Each cycle is 42 days.

Treatment is continued until disease progression, unacceptable toxicity, or for up to 24 months in patients without disease progression.

Patients should be monitored continuously (at least up to 5 months after the last dose) as an adverse reaction with nivolumab in combination with ipilimumab may occur at any time during or after discontinuation of therapy.

Facilities to treat anaphylaxis MUST be present when systemic anti-cancer therapy (SACT) is administered.

Admin. Order	Day	Drug	Dose	Route	Diluent & Rate	Cycle
1	1, 22	Nivolumab[1]	360mg	IV infusion	Infuse over 30 minutes through a sterile, non-pyrogenic, low protein binding in-line filter with a pore size of 0.2-1.2 µm[2]	Every 42 days ongoing to progression or toxicity (Max.24 months)
2	1	Ipilimumab[1]	1mg/kg	IV infusion Observe post infusion[3]	0.9% sodium chloride to a concentration between 1 and 4mg/ml over 30 minutes using a 0.2-1.2 µm low protein binding in-line filter[4].	Every 42 days ongoing to progression or toxicity(Max.24 months)
[1]Nivolumab or ipilimumab **must not** be administered as an intravenous push or bolus injection.						
[2]Nivolumab can be infused directly as a 10 mg/ml solution or can be diluted to as low as 1 mg/ml with sodium chloride 9mg/ml (0.9%) solution for injection or glucose 50 mg/ml (5%) solution for injection.						
[3]Vital signs including temperature, pulse and BP should be taken every 30 minutes for the duration of the infusion and 1 hour following completion of the infusion.						
[4]The line should be flushed with 0.9% sodium chloride after the ipilimumab infusion has finished.						

ELIGIBILITY:

- Indication as above
- Aged 18 years or above
- Histologically confirmed pleural malignant mesothelioma (epithelioid or non-epithelioid) not eligible for curative surgery
- ECOG status 0–1
- Nivolumab and ipilimumab are not recommended during pregnancy and in women of childbearing potential not using effective contraception unless prescribing consultant deems clinical benefit outweighs the potential risk. Effective contraception should be used for at least 5 months following the last dose of nivolumab
- Adequate haematological, renal and hepatic function

CAUTION:

- Patients with clinically significant autoimmune disease

EXCLUSIONS:

- Hypersensitivity to nivolumab, ipilimumab or to any of the excipients
- Primitive peritoneal, pericardial, testis or tunica vaginalis mesotheliomas
- Prior chemotherapy for pleural mesothelioma
- Prior treatment with an anti-PD-1/PD-L1, anti-PD-L2 or anti-CTLA-4 antibody
- Symptomatic CNS metastases
- Active autoimmune disease
- Any medical condition that requires immunosuppressive doses of systemic corticosteroids or other immunosuppressive medication(s) (defined as >10mg prednisolone/daily or steroid equivalent, excluding inhaled or topical steroids
- Symptomatic interstitial lung disease
- Any active clinically significant infection requiring therapy
- Breast feeding

PRESCRIPTIVE AUTHORITY:

The treatment plan must be initiated by a Consultant Medical Oncologist.

TESTS:

Baseline tests:

- FBC, renal and liver profile
- Glucose
- Thyroid Function Tests (TFTs)
- Virology: All patients should be tested for both HBsAg and HBcoreAb as per local policy and Hepatitis C (HCV RNA)

Regular tests:

- FBC, renal and liver profile prior to each cycle
- Glucose prior to each cycle
- TFTs prior to each cycle

Disease monitoring:

Disease monitoring should be in line with the patient's treatment plan and any other test/s as directed by the supervising Consultant.

DOSE MODIFICATIONS:

- Any dose modification should be discussed with a Consultant.
- Dose escalation or reduction is not recommended. Dosing delay or discontinuation may be required based on individual safety and tolerability.
- Management of immune-related adverse reactions may require dose interruption or permanent discontinuation of nivolumab in combination with ipilimumab therapy and institution of systemic high-dose corticosteroid (see Tables 1 and 3).
- If immunosuppression with corticosteroids is used to treat an adverse reaction, a taper of at least 1 month duration should be initiated upon improvement. Rapid tapering may lead to worsening or recurrence of the adverse reaction.
- Non-corticosteroid immunosuppressive therapy should be added if there is worsening or no improvement despite corticosteroid use. Nivolumab in combination with ipilimumab should not be resumed while the patient is receiving immunosuppressive doses of corticosteroids or other immunosuppressive therapy. Prophylactic antibiotics should be used to prevent opportunistic infections in patients receiving immunosuppressive therapy.
- Nivolumab in combination with ipilimumab must be permanently discontinued for;
    - Any severe immune-related adverse reaction that recurs
    - Any life-threatening immune-related adverse reaction
    - Any grade 4 or recurrent grade 3 adverse reactions, persistent grade 2 or 3 adverse reactions despite management
- When nivolumab is administered in combination with ipilimumab, if either agent is withheld, the other agent should also be withheld. If dosing is resumed after a delay, either the combination treatment or nivolumab monotherapy could be resumed based on the evaluation of the individual patient.
- Guidelines for withholding of doses or permanent discontinuation are described in Table 1 below.

Table 1: Dose modification of nivolumab and ipilimumab for adverse events

Immune-related adverse reaction	Severity	Treatment Modification
Immune-related pneumonitis	Grade 2 pneumonitis	Withhold dose(s) until symptoms resolve, radiographic abnormalities improve, and management with corticosteroids is complete
	Grade 3 or 4 pneumonitis	Permanently discontinue treatment
Immune-related colitis	Grade 2 diarrhoea or colitis	Withhold dose(s) until symptoms resolve and management with corticosteroids, if needed, is complete
	Grade 3 diarrhoea or colitis	Permanently discontinue treatment
	Grade 4 diarrhoea or colitis	Permanently discontinue treatment
Immune-related hepatitis	Grade 2 elevation in aspartate aminotransferase (AST), alanine aminotransferase (ALT), or total bilirubin	Withhold dose(s) until laboratory values return to baseline and management with corticosteroids, if needed, is complete
	Grade 3 or 4 elevation in AST, ALT, or total bilirubin	Permanently discontinue treatment
Immune-related nephritis and renal dysfunction	Grade 2 or 3 creatinine elevation	Withhold dose(s) until creatinine returns to baseline and management with corticosteroids is complete
	Grade 4 creatinine elevation	Permanently discontinue treatment
Immune-related endocrinopathies	Symptomatic Grade 2 or 3 hypothyroidism, hyperthyroidism, hypophysitis, Grade 2 adrenal insufficiency Grade 3 diabetes	Withhold dose(s) until symptoms resolve and management with corticosteroids (if needed for symptoms of acute inflammation) is complete. Treatment should be continued in the presence of hormone replacement therapy as long as no symptoms are present
	Grade 4 hypothyroidism Grade 4 hyperthyroidism Grade 4 hypophysitis Grade 3 or 4 adrenal insufficiency Grade 4 diabetes	Permanently discontinue treatment
Immune-related skin adverse reactions	Grade 3 rash	Withhold dose(s) until symptoms resolve and management with corticosteroids is complete
	Grade 4 rash	Permanently discontinue treatment
	Steven-Johnsons syndrome (SJS) or toxic	Permanently discontinue treatment

	epidermal necrolysis (TEN)	
Immune-related myocarditis	Grade 2 myocarditis Grade 3 or 4 myocarditis	Withhold dose(s) until symptoms resolve and management with corticosteroids is complete[a] Permanently discontinue treatment
Other immune-related adverse reactions	Grade 3 (first occurrence) Grade 4 or recurrent Grade 3; persistent Grade 2 or 3 despite treatment modification; inability to reduce corticosteroid dose to 10mg prednisone or equivalent per day	Withhold dose(s) Permanently discontinue treatment
Note: Toxicity grades are in accordance with National Cancer Institute Common Terminology Criteria for Adverse Events Version 4.0 (NCI-CTCAE v4). [a]The safety of re-initiating nivolumab or nivolumab in combination with ipilimumab therapy in patients previously experiencing immune-related myocarditis is not known.		

Renal and Hepatic Impairment:

Table 2: Dose modification of nivolumab and ipilimumab in renal and hepatic impairment

Drug	Renal Impairment		Hepatic Impairment	
Nivolumab	**Mild-Moderate**	No dose adjustment necessary	**Mild**	No dose adjustment necessary
	Severe	Has not been studied	**Moderate -Severe**	Has not been studied. Nivolumab must be administered with caution in patients with: • moderate (total bilirubin >1.5x to 3x ULN and any AST) or • severe (total bilirubin >3x ULN and any AST)
Ipilimumab	No specific dose adjustment is necessary in patients with mild to moderate renal dysfunction.		No specific dose adjustment is necessary in patients with mild hepatic impairment. Administer with caution in patients with transaminase levels ≥5x ULN or bilirubin levels >3x ULN at baseline.	

SUPPORTIVE CARE:

EMETOGENIC POTENTIAL:

Nivolumab: Minimal **(Refer to local Policy)**
Ipilimumab: Low **(Refer to local policy)**

PREMEDICATIONS: Not usually required

OTHER SUPPORTIVE CARE: No specific recommendations

ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS:

The adverse effects listed are not exhaustive. Please refer to the relevant Summary of Product Characteristics for full details.

Nivolumab and ipilimumab

- **Cardiac adverse events and pulmonary embolism**: Patients should be monitored for cardiac and pulmonary adverse reactions continuously, as well as for clinical signs, symptoms, and laboratory abnormalities indicative of electrolyte disturbances and dehydration prior to and periodically during treatment. Nivolumab in combination with ipilimumab should be discontinued for life-threatening or recurrent severe cardiac and pulmonary adverse reactions.
- **Immune-related adverse reactions**: Please see Table 3 for management for immune-related adverse reactions to nivolumab in combination with ipilimumab.

Table 3: Management of immune-related adverse reactions to nivolumab and ipilimumab in combination therapy

Adverse reaction	Withhold / discontinue	Recommended action -1st occurrence
Immune-related pneumonitis Patients should be monitored for signs and symptoms of pneumonitis such as radiographic changes (e.g. focal ground glass opacities, patchy filtrates), dyspnoea, and hypoxia. Infectious and disease-related aetiologies should be ruled out.		
Grade 2 (symptomatic)	Withhold nivolumab and ipilimumab	Initiate corticosteroids at a dose of 1 mg/kg/day methylprednisolone (/equivalents) Upon improvement, treatment may be resumed after corticosteroid taper.
If worsening or no improvement occurs despite initiation of corticosteroids	Permanently discontinue both nivolumab and ipilimumab	Increase corticosteroid dose to 2 to 4 mg/kg/day methylprednisolone (/equivalents)
Grade 3 or 4	Permanently discontinue both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 2 to 4 mg/kg/day methylprednisolone (/equivalents)
Immune-related colitis Patients should be monitored for diarrhoea and additional symptoms of colitis, such as abdominal pain and mucus or blood in stool. Infectious and disease-related aetiologies should be ruled out. Cytomegalovirus (CMV) infection/reactivation has been reported in patients with corticosteroid-refractory immune-related colitis. Consider if patient has persistent colitis despite appropriate colitis therapy.		
Grade 2 diarrhoea or colitis	Withhold both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 0.5 to 1 mg/kg/day methylprednisolone (/equivalents). Upon improvement, treatment may be resumed after corticosteroid taper.
If worsening or no improvement occurs despite initiation of corticosteroids		

	Permanently discontinue both nivolumab and ipilimumab	Increase corticosteroid dose to 1 to 2 mg/kg/day methylprednisolone (/equivalents)
Grade 3 diarrhoea or colitis	Permanently discontinue both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 1 to 2 mg/kg/day methylprednisolone (/equivalents)
Grade 4 diarrhoea or colitis	Permanently discontinue both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 1 to 2 mg/kg/day methylprednisolone (/equivalents)
Immune-related hepatitis Patients should be monitored for signs and symptoms of hepatitis such as transaminase and total bilirubin elevations. Infectious and disease-related aetiologies should be ruled out.		
Grade 2 transaminase or total bilirubin elevation	Withhold both nivolumab and ipilimumab	Persistent elevations in these laboratory values should be managed with corticosteroids at a dose of 0.5 to 1 mg/kg/day methylprednisolone equivalents. Upon improvement, treatment may be resumed after corticosteroid taper.
If worsening or no improvement occurs despite initiation of corticosteroids	Permanently discontinue both nivolumab and ipilimumab	Increase corticosteroid dose to 1 to 2 mg/kg/day methylprednisolone (/equivalents)
Grade 3 or 4 transaminase or total bilirubin elevation	Permanently discontinue both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 1 to 2 mg/kg/day methylprednisolone. (/equivalents)
Immune-related nephritis or renal dysfunction Patients should be monitored for signs and symptoms of nephritis and renal dysfunction. Most patients present with asymptomatic increases in serum creatinine. Disease-related aetiologies should be ruled out.		
Grade 2 or 3 serum creatinine elevation	Withhold both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 0.5 to 1 mg/kg/day methylprednisolone. (/equivalents) Upon improvement, treatment may be resumed after corticosteroid taper.
If worsening or no improvement occurs despite initiation of corticosteroids	Permanently discontinue both nivolumab and ipilimumab	Increase corticosteroid dose to 1 to 2 mg/kg/day methylprednisolone (/equivalents)
Grade 4 serum creatinine elevation	Permanently discontinue both nivolumab and ipilimumab	Initiate corticosteroids at a dose of 1 to 2 mg/kg/day methylprednisolone (/equivalents)
Immune-related endocrinopathies Patients should be monitored for clinical signs and symptoms of endocrinopathies and for hyperglycaemia and changes in thyroid function (at the start of treatment, periodically during treatment, and as indicated based on clinical evaluation). Patients may present with fatigue, headache, mental status changes, abdominal pain, unusual bowel habits, and hypotension, or nonspecific symptoms which may resemble other causes such as brain metastasis or underlying disease. Unless an alternate etiology has been identified, signs or symptoms of endocrinopathies should be considered immune-related.		
Symptomatic hypothyroidism	Withhold both nivolumab and ipilimumab	Thyroid hormone replacement should be initiated as needed

Symptomatic hyperthyroidism	Withhold both nivolumab and ipilimumab	Antithyroid medication should be initiated as needed. Corticosteroids at a dose of 1 to 2 mg/kg/day methylprednisolone equivalents should also be considered if acute inflammation of the thyroid is suspected. Upon improvement, treatment may be resumed after corticosteroid taper, if needed. Monitoring of thyroid function should continue to ensure appropriate hormone replacement is utilised.
Life-threatening hyperthyroidism or hypothyroidism	Permanently discontinue both nivolumab and ipilimumab	
Symptomatic Grade 2 adrenal insufficiency	Withhold both nivolumab and ipilimumab	Physiologic corticosteroid replacement should be initiated as needed.
Severe (Grade 3) or life-threatening (Grade 4) adrenal insufficiency	Permanently discontinue both nivolumab and ipilimumab	Monitoring of adrenal function and hormone levels should continue to ensure appropriate corticosteroid replacement is utilised
Symptomatic Grade 2 or 3 hypophysitis	Withhold both nivolumab and ipilimumab	Hormone replacement should be initiated as needed. Corticosteroids at a dose of 1 to 2 mg/kg/day methylprednisolone (/ equivalents) should also be considered if acute inflammation of the pituitary gland is suspected. Upon improvement, treatment may be resumed after corticosteroid taper, if needed.
Life-threatening (Grade 4) hypophysitis	Permanently discontinue both nivolumab and ipilimumab	Monitoring of pituitary function and hormone levels should continue to ensure appropriate hormone replacement is utilised.
Symptomatic diabetes	Withhold both nivolumab and ipilimumab	Insulin replacement should be initiated as needed. Monitoring of blood sugar should continue to ensure appropriate insulin replacement is utilised.
Life-threatening diabetes	Permanently discontinue both nivolumab and ipilimumab	
Immune-related skin adverse reactions		
Grade 3 rash	Withhold both nivolumab and ipilimumab	Severe rash should be managed with high-dose corticosteroid at a dose of 1 to 2 mg/kg/day methylprednisolone equivalents. Rare cases of Stevens-Johnson Syndrome (SJS) and toxic epidermal necrolysis (TEN), some of them with fatal outcome have been observed. If symptoms or signs of SJS or TEN appear, treatment should be discontinued and the patient referred to a specialised unit for assessment and treatment. If the patient has developed SJS
Grade 4 rash	Permanently discontinue both nivolumab and ipilimumab	

		or TEN with the use of nivolumab in combination with ipilimumab, permanent discontinuation of treatment is recommended. Caution should be used when considering the use of nivolumab in a patient who has previously experienced a severe or life-threatening skin adverse reaction on prior treatment with other immune-stimulatory anticancer agents.
Other immune-related adverse reactions For suspected immune-related adverse reactions, adequate evaluation should be performed to confirm aetiology or exclude other causes. Based on the severity of the adverse reaction, treatment should be withheld and corticosteroids administered. Upon improvement, treatment may be resumed after corticosteroid taper. Treatment must be permanently discontinued for any severe immune-related adverse reaction that recurs and for any life-threatening immune-related adverse reaction. Myotoxicity: ○ Cases of myotoxicity, some with fatal outcome, have been reported with nivolumab in combination with ipilimumab. If a patient develops signs and symptoms of myotoxicity, close monitoring should be implemented. Based on the severity of myotoxicity, nivolumab in combination with ipilimumab should be withheld or discontinued. Patients with cardiac or cardiopulmonary symptoms should be assessed for potential myocarditis. If myocarditis is suspected, prompt initiation of a high dose of steroids (prednisone 1 to 2 mg/kg/day or methylprednisolone 1 to 2 mg/kg/day). Once a diagnosis of myocarditis is established, nivolumab in combination with ipilimumab should be withheld or permanently discontinued (see Table 1).		
Infusion reactions		
Mild or moderate infusion reaction	Caution	May receive treatment with close monitoring and use of premedication according to local treatment guidelines for prophylaxis of infusion reactions.
Severe or life-threatening infusion reaction	Discontinue infusion	Administer appropriate medical therapy

DRUG INTERACTIONS:

- No formal pharmacokinetic drug interaction studies have been conducted with nivolumab. Since nivolumab is cleared from the circulation through catabolism, no metabolic drug-drug interactions are expected.
- The use of systemic corticosteroids or immunosuppressants before starting nivolumab in combination with ipilumumab should be avoided because of their potential interference with the pharmacodynamic activity and efficacy of nivolumab in combination with ipilimumab. However, systemic corticosteroids or other immunosuppressants can be used after starting nivolumab in combination with ipilimumab to treat immune-related adverse reactions.
- Concomitant use of ipilimumab with anti-coagulants may increase risk of GI haemorrhage so close monitoring is required.
- Current drug interaction databases should be consulted for more information.

COMPANY SUPPORT RESOURCES/Useful Links:

Please note that this is for information only and does not constitute endorsement by the NCCP

Patient Alert Card:
Nivolumab:
https://www.hpra.ie/img/uploaded/swedocuments/c02753be-51a5-44fd-8117-123823bdcff8.pdf
Ipilimumab:
https://www.hpra.ie/img/uploaded/swedocuments/0781c3d7-ff8d-4cc7-9f0a-80cf9a10e59f.pdf

Patient Information Guide:
Ipilimumab:
https://www.hpra.ie/img/uploaded/swedocuments/2f064c72-ccef-492b-a068-bc72d8b522cf.pdf

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Version	Date	Amendment	Approved By
1	14/4/2023		Prof Maccon Keane

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