

Pembrolizumab for Advanced Lung Cancer

An HCP Tool From the Immuno-Oncology Essentials Initiative

Programmed death receptor-1 (PD-1) is found on T cells and acts as a negative regulator of T-cell activation and proliferation, meaning it “turns the immune system off,” essentially acting as a brake. This type of inhibitory role is necessary to prevent excessive immune reactions and autoimmunity. For this reason, PD-1 and other regulators that act in this manner are known as immune checkpoints.

Programmed death ligand-1 (PD-L1) is a protein expressed on the surface of normal cells that helps regulate immune responses by interacting with the PD-1 receptor on T cells. This helps prevent

autoimmune reactions. However, we now understand that various tumors can exploit the PD-1/PD-L1 pathway to avoid immune detection. Some tumors will express PD-L1 on their cell surface just like normal cells, allowing them to interact with PD-1 on T cells and “turn off” the immune system, thereby remaining undetected.

Pembrolizumab (Keytruda®) is a PD-1 monoclonal antibody checkpoint inhibitor. Pembrolizumab selectively binds to PD-1, blocking the PD-1/PD-L1 interaction and thereby “exposing” cancer cells and “turning on” the immune system.

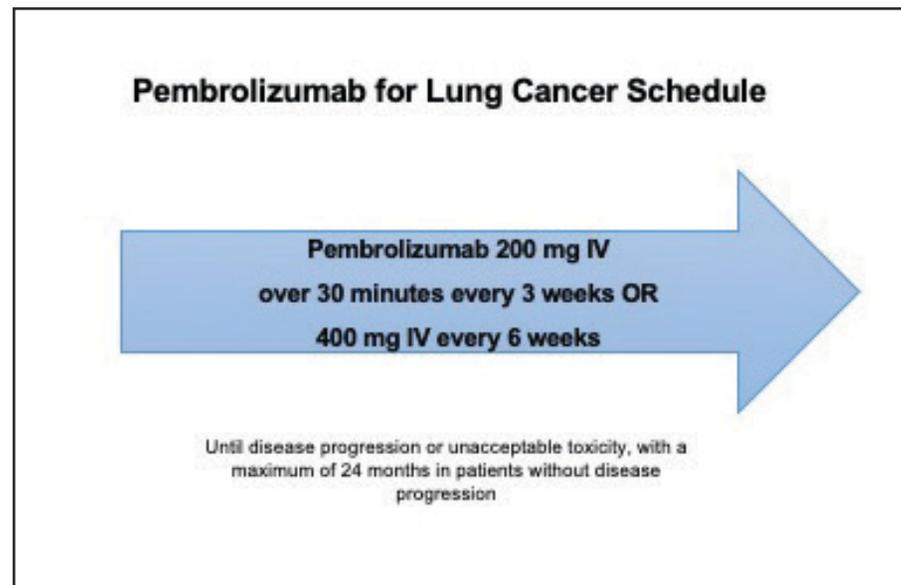
Non-small cell lung cancers (NSCLC) may express varying levels of PD-L1 on the cell surface. Pembrolizumab has been approved for 5 indications in NSCLC:

1. As a single agent for first-line treatment of patients with metastatic NSCLC whose tumors have high PD-L1 expression (Tumor proportion score [TPS] $\geq 1\%$), as determined by an FDA-approved test, with no EGFR mutation or ALK translocation. The disease is
 - Stage III and the patient is not a candidate for surgical resection or definitive chemoradiationOR
 - Metastatic
2. In combination with pemetrexed and platinum-containing chemotherapy, as first-line treatment of patients with metastatic nonsquamous NSCLC
3. In combination with carboplatin or either paclitaxel or paclitaxel protein-bound, as first-line treatment of patients with metastatic squamous NSCLC
4. As a single agent for the treatment of patients with metastatic NSCLC whose tumors express PD-L1 (TPS $> 1\%$), with disease progression on or after a platinum-containing chemotherapy regimen. Patients with EGFR or ALK mutations should have disease progression on FDA-approved therapy for these mutations before receiving pembrolizumab
5. Pembrolizumab is also approved for small cell lung cancer. The indication is:
 - For the treatment of patients with metastatic SCLC with disease progression on or after platinum-based chemotherapy and at least one other prior line of therapy

This document is part of an overall provider toolkit intended to assist in optimizing management of lung cancer in patients receiving newer lung cancer therapies.

DRUG DOSAGE/ADMINISTRATION

- For lung cancer, the recommended dose of pembrolizumab (Keytruda®) is 200 mg every 3 weeks or 400 mg every 6 weeks, administered as an intravenous infusion over 30 minutes for up to 24 months.



- Pembrolizumab solution is clear to slightly opalescent, colorless to slightly yellow. Discard the vial if visible particles are observed
- Pembrolizumab is provided as a 50 mg lyophilized powder in a single-dose vial for reconstitution or as a 100 mg/4 mL (25 mg/mL) solution in a single-dose vial. When reconstituting pembrolizumab for injection, slowly swirl the vial. Do NOT shake the vial
- Pembrolizumab is classified as an irritant and may be safely administered via a central or peripheral line. It is important to assure IV access before administration. Pembrolizumab should be administered through an intravenous line containing a sterile, non-pyrogenic, low-protein-binding in-line or add-on filter (pore size of 0.2 – 5 micrometers). Do not coadminister pembrolizumab with other drugs through the same intravenous line

SIDE EFFECTS AND THEIR MANAGEMENT

Because pembrolizumab is an immunotherapy that works by enhancing the patient’s immune system, most adverse reactions associated with pembrolizumab are related to overactivity of the patient’s immune system (ie, immune-related adverse events [irAEs]). Various organ systems (often more than one) or tissues may be affected.

- Keys to toxicity management:
 - » Proactive assessment for early signs/symptoms of toxicity
 - » Prompt intervention
 - » IrAEs are typically managed with treatment interruption and selective use of corticosteroids
 - » In rare instances, toxicity may not be responsive to steroid treatment, and additional immunosuppressive agents may be necessary (infliximab, mycophenolate mofetil, cyclophosphamide, etc)
 - » Pembrolizumab will likely be held or discontinued depending on severity and/or persistence
 - » Referral to organ specialist should be considered, given that unique testing and management strategies may be required
- IrAEs associated with pembrolizumab treatment can be categorized into those that are most common, less common but serious, and others that are easily overlooked. (Table 1; Appendix 1). Other adverse events associated with pembrolizumab therapy are listed in Appendix 2

Table 1. Care Step Pathways for the management of immune-related AEs associated with pembrolizumab monotherapy.

IrAEs category	Examples	Location
Most common	Skin toxicities (pruritis, rash, etc) Gastrointestinal toxicity—Diarrhea and colitis Thyroiditis Hepatic toxicities	Appendix 1
Less common but serious	Additional endocrinopathies - Hypophysitis (pituitary) - Adrenal insufficiency (adrenalitis) - Diabetes Pneumonitis	Appendix 1
Easily overlooked	Arthralgia/arthritis Mucositis/xerostomia Neuropathy Nephritis	Appendix 1

CLINICAL PEARLS

- It is important to monitor laboratory values at the start of treatment, periodically during treatment, and as indicated clinically. Laboratory values commonly monitored include: CBC w/ differential, creatinine, alkaline phosphatase, AST/ALT, bilirubin (direct/total), sodium, potassium, calcium, magnesium, thyroid function, and glucose. See individual irAE CSPs for more detail on laboratory monitoring
- Pembrolizumab-related irAEs may occur at any time, including after treatment completion or discontinuation
- Patients sometimes experience signs/symptoms that they think are due to “flu” or a cold, but that actually represent an irAE or an infusion reaction
- Endocrinopathies often present with vague symptoms (fatigue, headache, and/or depression) that can easily be overlooked or initially misdiagnosed. Hypervigilance and follow-up is important on the part of both HCPs and patients
- Endocrinopathies tend to occur somewhat more commonly with pembrolizumab or other PD-1 inhibitor therapies than with ipilimumab monotherapy
- Unlike other irAEs, endocrinopathies usually do not resolve and may require lifelong hormone replacement therapy
- IrAEs have different time courses. New irAEs may become apparent upon tapering of corticosteroids used to treat an earlier onset irAE, since the new irAE can be suppressed or masked by immunosuppressive therapy. Therefore, during the taper period, patients should be advised to be on the lookout for early signs of new irAEs as well as recurrence of the original irAE that was being treated
- HCPs should encourage patients to carry information about their pembrolizumab regimen with them at all times. This might be the pembrolizumab-specific wallet card, or at least emergency phone numbers and the side effects associated with the regimen. You may suggest that they paperclip the wallet and insurance cards together so information about their regimen will be shared whenever they show their insurance card
- Advise patients to take pictures of any skin changes for documentation

QUESTIONS & ANSWERS

Q. How long will patients stay on pembrolizumab?

A. The prescribing information indicates until disease progression or unacceptable toxicity or up to 24 months in patients without disease progression.

Q. Is PD-L1 testing required for patients to be eligible to receive pembrolizumab?

A. PD-L1 testing is recommended for all patients diagnosed with non-small cell lung cancer, preferably at diagnosis. PD-L1 expression by an FDA-approved test is reported as tumor proportion score (TPS). Low = <1%; Moderate = 1-49%; high = >50%.

Q. Are there standard dosage reductions for irAEs associated with pembrolizumab?

A. There are no dosage reductions for irAEs associated with pembrolizumab. The dose is either held until the irAE resolves sufficiently (typically to Grade 0 or Grade 1) or, if the irAE is severe enough, pembrolizumab is discontinued permanently.

Q. Does the safety profile of pembrolizumab differ when it is used in various tumor types?

A. Generally, the safety profile of pembrolizumab is similar across tumor types. However, the context may be different—patients with other tumor types may have differing comorbidities or underlying organ dysfunction. For example, lung cancer patients may have underlying lung disease that will exacerbate shortness of breath associated with pneumonitis. The side-effect profile may vary if given as monotherapy or in combination with chemotherapy.

Q. How do I counsel my patients about immunizations?

A. That's a logical question, given that the checkpoint inhibitors alter the immune response. Advise your patients not to receive live vaccines (eg, measles, mumps, and rubella and the varicella vaccine [Zostavax[®]]) because they have not been evaluated in this setting. The use of attenuated vaccines has been and continues to be evaluated. Counsel patients to discuss all immunizations with the oncology team prior to administration so the benefits and risks can be weighed on an individual basis. For example, SHINGRIX[®], approved in 2017, is an attenuated (non-live) varicella vaccine; its use should be discussed with the oncology team if a recommendation is being made for the patient to receive the injection series. Patients should be encouraged to get the inactivated influenza vaccine annually. The nasal spray flu vaccine is a live attenuated influenza vaccine and should not be administered to patients treated with immune checkpoint inhibitors.

PATIENT RESOURCES

Financial Assistance

The Merck Access Program

1-855-257-3932

www.keytruda.com/keytruda-cost/

Additional Information Resources

American Cancer Society Resource Section

<http://www.cancer.org/cancer/non-small-cell-lung-cancer/treating/immunotherapy.html>

GO2 Foundation for Lung Cancer

<http://go2foundation.org>

Lung Cancer Alliance

<http://lungcanceralliance.org/resources-and-support/general-support/educational-materials>

ADDITIONAL RESOURCES

- Boutros C, Tarhini A, Routier E, et al. Safety profiles of anti-CTLA-4 and anti-PD-1 antibodies alone and in combination. *Nat Rev Clin Oncol*. 2016;13:473-486.
- Brahmer JR, Lacchetti C, Schneider BJ, et al. Management of immune-related adverse events in patients treated with immune checkpoint inhibitor therapy: American Society of Clinical Oncology clinical practice guideline. *J Clin Oncol*. 2018;36:1-60.
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- Friedman CF, Proverbs-Singh TA, Postow MA. Treatment of the immune-related adverse effects of immune checkpoint inhibitors: a review. *JAMA Oncol*. 2016;2:1346-1353.
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Available at: http://www.merck.com/product/usa/pi_circulars/k/keytruda/keytruda_pi.pdf.
- Kumar V, Chaudhary N, Garg M, Floudas CS, Soni P, Chandra AB. Current diagnosis and management of immune related adverse events (irAEs) induced by immune checkpoint inhibitor therapy. *Front Pharmacol*. 2017;8:49. doi: 10.3389/fphar.2017.00049.
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- McGettigan S, Rubin KM. Managing adverse events with PD-1 inhibitor therapy of advanced melanoma: consensus statements from the faculty of the melanoma nursing initiative. *Clin J Oncol Nurs*. 2017;21(Suppl):42-51.

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ADDITIONAL RESOURCES

Continued

- Naidoo J, Page DB, Li BT, et al. Toxicities of the anti-PD-1 and anti-PD-L1 immune checkpoint inhibitor antibodies. *Ann Oncol*. 2015;26:2375-2391.
- National Comprehensive Cancer Network (NCCN). NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines[®]): Management of Immunotherapy-Related Toxicities, Version 1.2020: Featured updates to the NCCN Guidelines. *JNCCN*. 2020;18(3):230-241.
- Nishijima TF, Shachar SS, Nyrop KA, Muss HB. Safety and tolerability of PD-1/PD-L1 inhibitors compared with chemotherapy in patients with advanced cancer: a meta-analysis. *Oncologist*. 2017;22:470-479.
- Puzanov I, Diab A, Abdallah K, et al. Managing toxicities associated with immune checkpoint inhibitors: consensus recommendations from the Society for Immunotherapy of Cancer (SITC) Toxicity Management Working Group. *J Immunother Cancer*. 2017;5:95. doi: 10.1186/s40425-017-0300-z.
- Spain L, Diem S, Larkin J. Management of toxicities of immune checkpoint inhibitors. *Cancer Treat Rev*. 2016;44:51-60.
- Villadolid J, Amin A. Immune checkpoint inhibitors in clinical practice: update on management of immune-related toxicities. *Trans Lung Cancer Res*. 2015;4:560-577.
- Weber JS, Postow M, Lao CD, Schadendorf D. Management of adverse events following treatment with anti-programmed death-1 agents. *Oncologist*. 2016;21:1230-1240.

[Click here for downloadable action plans to customize for your patients](#)

APPENDIX 1

The 12 Care Step Pathways (CSPs) referenced in this Appendix are housed in the CSP section of the AIMWithImmunotherapy.com IO Essentials website. These CSPs are currently universally applicable (i.e., they don't differ across tumor types).

Please click the link below to access the CSPs, which can also be printed from that section of the site.

<http://aimwithimmunotherapy.org/care-step-pathways/>

APPENDIX 2

Management of other AEs associated with PD-1 inhibitor monotherapy

Adverse event	Common symptoms	Common management/anticipatory guidance
Anorexia	Decreased appetite	<ul style="list-style-type: none"> • Monitor weight; query patient about appetite/eating habits; advise dietary modification if necessary (should improve with time) • Anticipate standard dose holds/discontinuations* • Consider referral to nutrition services for counseling on best food choices to avoid excessive weight loss
Constipation/ abdominal pain	Infrequent stools/ difficulty stooling, abdominal pain	<ul style="list-style-type: none"> • Consider other causes, such as opioid-induced constipation • Increase fluid, fiber; use laxatives with caution; suggest stool softeners and physical activity • Consider appropriate testing to evaluate bowel obstruction • Anticipate standard dose holds/discontinuations* for Grade 3 and Grade 4 (constipation with manual evacuation indicated, severe abdominal pain, or life-threatening consequences)
Embryo-fetal toxicity	—	<ul style="list-style-type: none"> • Advise of risk to fetus and recommend use of effective contraception during treatment and for 4 months after pembrolizumab is discontinued • Advise patients to tell their HCPs immediately if they or their partners suspect they are pregnant while taking therapy
Encephalitis	Headache, fever, tiredness, confusion, memory problems, sleepiness, hallucinations, seizures, stiff neck	<ul style="list-style-type: none"> • New-onset, moderate-to-severe symptoms: rule out infectious or other causes • Counsel neurologist, obtain brain MRI, and lumbar puncture • Anticipate standard dose-holds and discontinuations*
Fatigue	Feeling tired; lack of energy	<ul style="list-style-type: none"> • Query patients regarding energy level; evaluate possible contributory factors, including infection, disease progression, and hematological and metabolic abnormalities; standard supportive care • Anticipate standard dose holds/discontinuations* • Fatigue that interferes with ADLs is concerning and should be evaluated for underlying causes, such as possible endocrinopathy
Headache	Head pain	<ul style="list-style-type: none"> • Need to rule out brain metastases, encephalitis, or hypophysitis; otherwise, standard supportive care (should improve with time) • Headache occurring in conjunction with fatigue could be indicative of hypophysitis; obtain MRI of brain with pituitary slices/pituitary protocol to confirm/rule out • Anticipate standard dose holds/discontinuations*

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Management of other AEs associated with PD-1 inhibitor monotherapy (Continued)

Adverse event	Common symptoms	Common management/anticipatory guidance
Infusion reaction	Chills/shaking, back pain, itching, flushing, difficulty breathing, hypotension, fever	<ul style="list-style-type: none"> Monitor patients for signs and symptoms. For grade 3 or 4 reactions: stop infusion and permanently discontinue pembrolizumab
Insomnia	Difficulty falling or staying asleep	<ul style="list-style-type: none"> Counsel patients on good sleep habits; prescription medications can be used if needed (should improve over time) Anticipate standard dose holds/discontinuations*
Myocarditis	Shortness of breath; arrhythmia; light-headedness; chest pain; fatigue; nausea; edema	<ul style="list-style-type: none"> Obtain baseline ECG Assess cardiac biomarkers (BNP; troponin) Control cardiac diseases (and risk factors) optimally Consult cardiologist and consider corticosteroids if myocarditis is suspected Add additional immunosuppressive agents in severe, refractory cases Institute standard dose holds/discontinuations (in consultation with cardiologist)
Nausea/vomiting	Vomiting, queasiness, RUQ or LUQ pain	<ul style="list-style-type: none"> Rule out brain metastases and gastroenteritis Provide standard supportive care, since it is adequate in most cases Check LFTs/lipase/amylase if hepatotoxicity or pancreatitis are suspected Anticipate standard dose holds/discontinuations*
Upper respiratory tract infection	Cough, runny nose, sore throat, nasal congestion	<ul style="list-style-type: none"> Evaluate potential causes—a dry cough and shortness of breath would increase concern for pneumonitis Standard supportive care Anticipate standard treatment holds*
Vision changes	Eye redness, pain, blurred vision, photophobia	<ul style="list-style-type: none"> Test and evaluate for uveitis and episcleritis (by ophthalmologist, preferably) Urgency of ophthalmology referral increases with grade G1: continue immunotherapy, use artificial tears G2: hold immunotherapy; ophthalmic and systemic corticosteroids (under ophthalmologist guidance) G3 or G4: permanently discontinue immunotherapy; treatment by ophthalmologist to include ophthalmic and systemic corticosteroids

*Withhold pembrolizumab for any Grade 3 (severe) AE. Permanently discontinue for any Grade 4 (life-threatening) AE, persistent Grade 2–3 AE, any severe (Grade 3) AE that recurs, or when ≥ 10 mg/d prednisone or equivalent is required for 12 weeks. Resume treatment when AE returns to Grade 0 or 1.