International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	PEMBROLIZUMAB - REVIEW OF USE AND EFFECTIVENESS IN THE TREATMENT OF SELECTED NEOPLASM
DOI	https://doi.org/10.31435/ijitss.4(48).2025.4453
RECEIVED	14 October 2025
ACCEPTED	10 December 2025
PUBLISHED	29 December 2025
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

PEMBROLIZUMAB - REVIEW OF USE AND EFFECTIVENESS IN THE TREATMENT OF SELECTED NEOPLASM

Konrad Kulka *(Corresponding Author, Email: konrad.kulka123@gmail.com)*
Municipal Hospital in Zabrze, Zabrze, Poland
ORCID ID: 0009-0007-6397-8777

Wiktoria Król
Municipal Hospital in Zabrze, Zabrze, Poland
ORCID ID: 0009-0007-3349-5395

Zuzanna Kafara
5th Military Hospital with Polyclinic in Cracow, Kraków, Poland
ORCID ID: 0009-0002-5983-5611

Donata Kowalczyk
5th Military Hospital with Polyclinic in Cracow, Kraków, Poland
ORCID ID: 0009-0008-8965-0689

Zuzanna Lechowska
Gabriel Narutowicz Hospital, Kraków, Poland
ORCID ID: 0009-0008-0430-3996

Agnieszka Kafara
Jagiellonian University Medical College, Kraków, Poland
ORCID ID: 0009-0005-7168-5291

Rafał Szarek
5th Military Hospital with Polyclinic in Cracow, Kraków, Poland
ORCID ID: 0009-0001-9118-0769

Julia Koronczok-Matusiak
J. Gromkowski Voivodship Specialist Hospital in Wrocław, Wrocław, Poland
ORCID ID: 0009-0001-8100-8527

Katarzyna Michta
Medical University of Gdańsk, Gdańsk, Poland
ORCID ID: 0009-0000-2937-0257

Dominika Jurczak
Bonifraters Medical Center Ltd., St. John of God Brothers' Hospital, Kraków, Poland
ORCID ID: 0009-0007-6042-5659

ABSTRACT

The growing number of oncological patients worldwide pushes the need to research new possibilities in cancer treatment. Cancer cells use various mechanisms to avoid destruction. One of them is the PD-1/PD-L1 pathway which is used by neoplasm cells to inhibit immune response from T-cells. Pembrolizumab, a monoclonal antibody, is targeted against PD-1 receptors, therefore enhances anti-cancer T-cell activity by disabling PD-1/PD-L1 interaction. This study summarizes the current state of knowledge on clinical usefulness and efficiency of pembrolizumab monotherapy, therapy combined with chemotherapy and perioperative use in melanoma, non-small cell lung cancer, pleural mesothelioma, classic Hodgkin lymphoma, urothelial cancer, head and neck squamous cell carcinoma, renal cell carcinoma, high-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm, esophageal cancer, triple negative breast cancer, endometrial cancer, cervical cancer, adenocarcinoma of the stomach or gastroesophageal junction and bile duct cancer. Patients who received pembrolizumab during clinical trials had longer median overall survival and progression free survival rates than patients in placebo groups. Higher expression levels of PD-L1 on tumor cells correlated with greater clinical response, however pembrolizumab therapy was also beneficial in patients with lower expression levels.

KEYWORDS

Pembrolizumab, Cancer, Neoplasm, PD-1, PD-L1

CITATION

Konrad Kulka, Wiktoria Król, Zuzanna Kafara, Donata Kowalczyk, Zuzanna Lechowska, Agnieszka Kafara, Rafał Szarek, Julia Koronczok-Matusiak, Katarzyna Michta, Dominika Jurczak. (2025) Pembrolizumab - Review of Use and Effectiveness in the Treatment of Selected Neoplasm. *International Journal of Innovative Technologies in Social Science*. 4(48). doi: 10.31435/ijitss.4(48).2025.4453

Introduction

Prolonged average life expectancy, many carcinogenes in the environment, lack of quality food combined with consumption of ultraprocessed foods and decrease of daily physical activity leads to an increasing number of neoplasm cases in today's society. In Poland alone, they cause over 25% of all deaths, second only to cardiovascular diseases. Neoplasm cells are characterized by different expression levels of surface molecules caused by mutations, which they undergo during the cancer transformation process. Among these molecules are PD-L1 and PD-L2 ligands whose expression on membranes are higher than in normal, healthy cells. PD-1/PD-L1 pathway is used by tumor cells to silence the human immune system and evade its anti-cancer activity. Those ligands bind to PD-1 receptors which are located on membranes of T-cells and cause inhibition of their activity [1,2]. Pembrolizumab is a humanized monoclonal IgG4 antibody which targets PD-1 receptors located on T-cells [3]. Pembrolizumab binds with PD-1 and blocks its interaction with PD-L1 and PD-L2 which prevents it from passing on inhibiting signals to T-cells [1]. As a result of blocking PD-1 pathway, previously exhausted, cytotoxic T-cells are no longer inhibited which leads to their proliferation and increase in anti-tumor activity. This process enhances immunological activity targeted at neoplasm cells which is a base of action of pembrolizumab in treatment of numerous patients in the field of oncology. Its current indications for use are melanoma, non-small cell lung cancer, pleural mesothelioma, classic Hodgkin lymphoma, urothelial cancer, head and neck squamous cell carcinoma, renal cell carcinoma, high-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm, esophageal cancer, triple negative breast cancer, endometrial cancer, cervical cancer, adenocarcinoma of the stomach or gastroesophageal junction and bile duct cancer. The purpose of this article is to review the current state of knowledge respecting pembrolizumab's clinical use in previously mentioned types of cancer and its efficiency.

Methodology

This article is based on existing studies published from 2015 to 2025 describing clinical application of pembrolizumab in treatment of various neoplasm types including melanoma, non-small cell lung cancer, pleural mesothelioma, classic Hodgkin lymphoma, urothelial cancer, head and neck squamous cell carcinoma, renal cell carcinoma, high-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm, esophageal cancer, triple negative breast cancer, endometrial cancer, cervical cancer, adenocarcinoma of the stomach or gastroesophageal junction and bile duct cancer. The references included in the bibliography were sourced from the PubMed database. The purpose of this paper is to gather all available information regarding the efficiency of pembrolizumab and potential benefits from including it in therapy of cancer types listed above.

Results

As stated before pembrolizumab is currently used in treatment of many neoplasm types. Throughout the last decade there have been many studies that dived deep into its efficiency and benefits that come from its inclusion in the therapy. Gathered information about precise indications of use and efficiency of therapy in melanoma, non-small cell lung cancer, pleural mesothelioma, classic Hodgkin lymphoma, urothelial cancer, head and neck squamous cell carcinoma, renal cell carcinoma, high-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm, esophageal cancer, triple negative breast cancer, endometrial cancer, cervical cancer, adenocarcinoma of the stomach or gastroesophageal junction and bile duct cancer are presented below in listed order.

Melanoma

Pembrolizumab is used as a first-line treatment in unresectable or metastatic melanoma. KEYNOTE-001 study showed that its inclusion in therapy resulted in overall survival (OS) after 5 years at 34% in the whole group and 41% in the group which did not get any other treatment earlier. Progression free survival (PFS) was 21% and 29% respectively in these groups [4]. Additionally a 10 year follow-up study, KEYNOTE-006, resulted in OS 34% in the group of patients with stage III or stage IV unresectable melanoma [5]. Indication of use also includes adjuvant therapy after radical surgical removal of high risk stage III melanoma. PFS in this group was presented in KEYNOTE-054 and after 7 years was 50% in the pembrolizumab group versus 36% in the placebo group [6].

Non-small cell lung cancer

Pembrolizumab in monotherapy gives significant therapeutic benefits when PD-L1 expression on cancer cells is 50% or more. Outcome of KEYNOTE-024 study shows that inclusion of pembrolizumab leads to OS 80.2% versus 72.4% in the platinum- based chemotherapy group. PFS in these groups was 10.3 months and 6.0 months respectively [7]. KEYNOTE-189 indicates that first-line treatment consisting of pembrolizumab combined with pemetrexed and platinum gives better results than therapy without inclusion of this anti-PD-1 monoclonal antibody. Median OS in the pembrolizumab group was 22.0 months, while in the placebo group it was 10.7 months. Median PFS was 9.0 months and 4.9 months respectively. Therapeutic benefits of pembrolizumab inclusion were observed from PD-L1 expression level.1% or more on cancer cells, while the most beneficial treatment was when these levels were at 50% or more [8].Perioperative neoadjuvant or adjuvant use in patients with surgically removed tumor results in event-free survival (EFS) after 2 years at 62.4% versus 40.6% in placebo group [9]. In metastatic non-small cell lung cancer, adding pembrolizumab to chemotherapy gives OS after 1 year at 69.2% compared with 49.4% in chemotherapy plus placebo group [10].

Pleural mesothelioma

Application of pembrolizumab with chemotherapy in pleural mesothelioma significantly improves median OS to 17.3 months compared with 16.1 months in chemotherapy alone. OS was 25% and 17% respectively in these groups, which shows its beneficial effect after inclusion to treatment [11].

Classic Hodgkin Lymphoma (cHL)

Pembrolizumab used in treatment of relapsed or refractory classical Hodgkin lymphoma is characterized by PFS 13.2 months contrast to 8.3 months in the group receiving brentuximab vedotin [12]. In group of patients with relapsed or refractory classical Hodgkin lymphoma and progressive disease after autologous stem cell transplantation or two other therapies when autologous stem cell transplantation was not possible after inclusion of pembrolizumab PFS was 13.7 months and a quarter of responders, including half of complete responders, maintained a response for ≥4 years [13].

Urothelial cancer

KEYNOTE-052 studied the effect of pembrolizumab as a first line treatment in cisplatin-ineligible patients with locally advanced and unresectable or metastatic urothelial cancer. After 1 year OS was at 46.9% in all participants who received pembrolizumab and 60.7% for patients with a combined positive score of PD-L1 expression level ≥ 10% [14]. KEYNOTE-045 study resulted in Median 1- and 2-year OS rates higher with pembrolizumab at 44.2% and 26.9% respectively than chemotherapy at 29.8% and 14.3%, respectively in recurrent advanced urothelial cancer [15]. The effect of pembrolizumab as a Second-Line Therapy for Advanced Urothelial Carcinoma was OS at 8.0 months compared with 5.2 months in the chemotherapy group [16]. Usage as adjuvant therapy of pembrolizumab in Muscle-Invasive Urothelial Carcinoma was studied with outcome median disease-free survival at 29.6 months compared to 14.2 months with observation [17].

Head and neck squamous cell carcinoma

Pembrolizumab plus platinum and 5-fluorouracil is an appropriate first-line treatment for recurrent or metastatic HNSCC with OS 13.0 months compared with 10.7 months in group with treatment consisting of cetuximab and chemotherapy according to KEYNOTE-048 [18]. When used as Neoadjuvant and Adjuvant in Locally Advanced HNSCC pembrolizumab showed event-free survival after 3 years at 59.8% versus 45.9% in the control group [19].

Renal cell carcinoma

Study on Advanced Renal-Cell Carcinoma Estimated percentage of patients who were alive at 12 months was 89.9% in the pembrolizumab-axitinib group and 78.3% in the sunitinib group. Median PFS was 15.1 months and 11.1 months respectively [20]. Another study concentrated on pembrolizumab as adjuvant in renal-cell carcinoma indicated that estimated overall survival at 48 months was 91.2% in the pembrolizumab group, as compared with 86.0% in placebo group [21].

High-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm

Patients with previously treated unresectable or metastatic MSI-H/dMMR noncolorectal cancer also benefit from pembrolizumab therapy. Median PFS was 4.1 months while median OS was 23.5 months. 27 tumor types were represented among enrolled patients with endometrial, gastric, cholangiocarcinoma, and pancreatic cancers being the most common [22].

Esophageal cancer

Application of pembrolizumab for patients with advanced esophageal cancer was studied during KEYNOTE-181.Estimated 12-month OS rate was 43% with pembrolizumab versus 20% with chemotherapy and median OS was 8.2 months versus 7.1 months [23]. Another study tested the efficiency of pembrolizumab plus chemotherapy versus chemotherapy plus placebo as first line treatment in advanced oesophageal cancer. In all randomised patients OS was 12.4 months in pembrolizumab plus chemotherapy group versus 9.8 months in chemotherapy plus placebo group. PFS in all patients was 6.3 months versus 5.8 months respectively [24].

Triple negative breast cancer

In previously untreated locally recurrent inoperable or metastatic triple-negative breast cancer study has shown median PFS at 9.7 months with pembrolizumab plus chemotherapy and 5.6 months with placebo plus chemotherapy [25]. Another research indicates that pembrolizumab not only increased pathologic complete response (pCR) rates but also improved EFS among most patients who do not have a pCR [26].

Endometrial cancer

Therapy consisting of pembrolizumab and lenvatinib resulted in median PFS at 6.6 months versus 3.8 months in the chemotherapy group. Median OS was 18.3 months versus 11.4 months respectively [27]. In KEYNOTE-158 study patients with MSI-H/dMMR endometrial cancer, who were previously treated, received pembrolizumab monotherapy and reached PFS 13.1 months [28].

Cervical cancer

Patients with PD-L1 positive metastatic or unresectable cervical cancer that has progressed during chemotherapy, who received pembrolizumab had OS at 53.0% versus 41.7% in the placebo group after 2 years. Median PFS was 10.4 months versus 8.2 months respectively in both groups [29]. As first-line treatment pembrolizumab combined with chemotherapy gave results of median OS 26.4 months versus 16.8 months when it comes to placebo with chemotherapy in all-comer groups [30]. Pembrolizumab plus chemoradiotherapy also improved PFS in patients with newly diagnosed, high-risk, locally advanced cervical cancer [31].

Adenocarcinoma of the stomach or gastroesophageal junction

In HER2-negative advanced gastric cancer with PD-L1 CPS ≥ 10 median OS was 15.7 months versus 11.8 months in pembrolizumab plus chemotherapy and placebo plus chemotherapy groups respectively [32]. Another study focused on patients with locally advanced or metastatic HER2-positive gastro-oesophageal junction adenocarcinoma without previous first-line treatment showed median PFS 10.0 months in pembrolizumab group versus 8.1 months in placebo group [33].

Biliary tract cancer

According to the KEYNOTE-966 study, patients with biliary tract cancer had a median OS of 12.7 months when receiving pembrolizumab while 10.9 months has been reached in the group of patients who received placebo [34]. Another study suggests that some biliary tract cancer types respond to pembrolizumab, but there are no known prognostic factors to predict its treatment benefits. The outcome of this study was median OS of 6.0 months and median PFS of 1.9 months [35].

Discussion

Data gathered from mentioned studies clearly shows that inclusion of pembrolizumab in treatment of melanoma, non-small cell lung cancer, pleural mesothelioma, classic Hodgkin lymphoma, urothelial cancer, head and neck squamous cell carcinoma, renal cell carcinoma, high-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm, esophageal cancer, triple negative breast cancer, endometrial cancer, cervical cancer, adenocarcinoma of the stomach or gastroesophageal junction and bile duct cancer is highly beneficial to patients. Median overall survival rates in pembrolizumab groups were significantly higher than in placebo groups. Median progression free survival was also generally higher in pembrolizumab receiving patient groups. Analyzed data also indicates that the higher levels of PD-L1 expression in tumor cells come with more therapeutic benefits including longer median overall survival and progression free survival, however smaller expression cases can also benefit from treatment. These results are very promising, especially considering the fact that some of the analyzed studies referred to patients with metastatic cancer, which means another therapeutic option is possible when standard treatment was not sufficient or has been started too late. Moreover, application as neoadjuvant or adjuvant in perioperative period also comes with longer overall survival and progression free survival, which is beneficial to patients who are qualified for surgical removal of tumor. However, not only these markers are important. Quality of life in oncological patients is also essential and this is also improved when pembrolizumab is included in therapy. Given how a large group of neoplasms is represented in analyzed studies with high efficiency in treatment, it is comforting and promising for further development in other types of cancer.

Conclusions

Pembrolizumab is highly efficient in treatment of melanoma, non-small cell lung cancer, pleural mesothelioma, classic Hodgkin lymphoma, urothelial cancer, head and neck squamous cell carcinoma, renal cell carcinoma, high-level microsatellite instability (MSI-H) or demismatch repair deficiency (dMMR) neoplasm, esophageal cancer, triple negative breast cancer, endometrial cancer, cervical cancer, adenocarcinoma of the stomach or gastroesophageal junction and bile duct cancer. Its application comes with longer median overall survival and progression free survival rates. Studies on its further use in oncology should be continued and expanded on other types of neoplasm. Monotherapy, adjuvant therapy, neoadjuvant therapy and combinations with already existing drugs should be examined in the future as pembrolizumab shows a versatile profile of clinical usefulness. Additionally, knowledge on correlation of PD-L1 expression on cancer cells with efficiency of treatment should be developed in the future as it opens up many possibilities of personalized therapies in oncology in the time to come.

Acknowledgments: All authors have reviewed and approved the final version of the manuscript for publication.

Conflict of Interest: The authors declare that there is no conflict of interest with any financial organization in connection with the material discussed in the manuscript.

Funding: This study has not received any specific grants from any funding agency in the public, commercial or non-profit sectors.

Board Statement: The paper did not require the approval of the bioethics committee, as it is a review publication based on the available literature.

Statement of Informed Consent: Not applicable.

REFERENCES

1. Kwok G, Yau TC, Chiu JW, Tse E, Kwong YL. Pembrolizumab (Keytruda). *Hum Vaccin Immunother*. 2016;12(11):2777-2789. doi:10.1080/21645515.2016.1199310
2. Liu J, Chen Z, Li Y, Zhao W, Wu J, Zhang Z. PD-1/PD-L1 Checkpoint Inhibitors in Tumor Immunotherapy. *Front Pharmacol*. 2021;12:731798. Published 2021 Sep 1. doi:10.3389/fphar.2021.731798
3. Centanni M, Moes DJAR, Trocóniz IF, Ciccolini J, van Hasselt JGC. Clinical Pharmacokinetics and Pharmacodynamics of Immune Checkpoint Inhibitors. *Clin Pharmacokinet*. 2019;58(7):835-857. doi:10.1007/s40262-019-00748-2
4. Hamid O, Robert C, Daud A, et al. Five-year survival outcomes for patients with advanced melanoma treated with pembrolizumab in KEYNOTE-001. *Ann Oncol*. 2019;30(4):582-588. doi:10.1093/annonc/mdz011
5. Long GV, Carlino MS, McNeil C, et al. Pembrolizumab versus ipilimumab for advanced melanoma: 10-year follow-up of the phase III KEYNOTE-006 study. *Ann Oncol*. 2024;35(12):1191-1199. doi:10.1016/j.annonc.2024.08.2330
6. Eggermont AM, Kicinski M, Blank CU, et al. Seven-year analysis of adjuvant pembrolizumab versus placebo in stage III melanoma in the EORTC1325 / KEYNOTE-054 trial. *Eur J Cancer*. 2024;211:114327. doi:10.1016/j.ejca.2024.114327
7. Reck M, Rodríguez-Abreu D, Robinson AG, et al. Pembrolizumab versus Chemotherapy for PD-L1-Positive Non-Small-Cell Lung Cancer. *N Engl J Med*. 2016;375(19):1823-1833. doi:10.1056/NEJMoa1606774
8. Mok TSK, Wu YL, Kudaba I, et al. Pembrolizumab versus chemotherapy for previously untreated, PD-L1-expressing, locally advanced or metastatic non-small-cell lung cancer (KEYNOTE-042): a randomised, open-label, controlled, phase 3 trial. *Lancet*. 2019;393(10183):1819-1830. doi:10.1016/S0140-6736(18)32409-7
9. Wakelee H, Liberman M, Kato T, et al. Perioperative Pembrolizumab for Early-Stage Non-Small-Cell Lung Cancer. *N Engl J Med*. 2023;389(6):491-503. doi:10.1056/NEJMoa2302983
10. Gandhi L, Rodríguez-Abreu D, Gadgeel S, et al. Pembrolizumab plus Chemotherapy in Metastatic Non-Small-Cell Lung Cancer. *N Engl J Med*. 2018;378(22):2078-2092. doi:10.1056/NEJMoa1801005
11. Chu Q, Perrone F, Greillier L, et al. Pembrolizumab plus chemotherapy versus chemotherapy in untreated advanced pleural mesothelioma in Canada, Italy, and France: a phase 3, open-label, randomised controlled trial. *Lancet*. 2023;402(10419):2295-2306. doi:10.1016/S0140-6736(23)01613-6
12. Kuruvilla J, Ramchandren R, Santoro A, et al. Pembrolizumab versus brentuximab vedotin in relapsed or refractory classical Hodgkin lymphoma (KEYNOTE-204): an interim analysis of a multicentre, randomised, open-label, phase 3 study. *Lancet Oncol*. 2021;22(4):512-524. doi:10.1016/S1470-2045(21)00005-X
13. Armand P, Zinzani PL, Lee HJ, et al. Five-year follow-up of KEYNOTE-087: pembrolizumab monotherapy for relapsed/refractory classical Hodgkin lymphoma. *Blood*. 2023;142(10):878-886. doi:10.1182/blood.2022019386
14. Balar AV, Castellano D, O'Donnell PH, et al. First-line pembrolizumab in cisplatin-ineligible patients with locally advanced and unresectable or metastatic urothelial cancer (KEYNOTE-052): a multicentre, single-arm, phase 2 study. *Lancet Oncol*. 2017;18(11):1483-1492. doi:10.1016/S1470-2045(17)30616-2
15. Fradet Y, Bellmunt J, Vaughn DJ, et al. Randomized phase III KEYNOTE-045 trial of pembrolizumab versus paclitaxel, docetaxel, or vinflunine in recurrent advanced urothelial cancer: results of >2 years of follow-up. *Ann Oncol*. 2019;30(6):970-976. doi:10.1093/annonc/mdz127
16. Bellmunt J, de Wit R, Vaughn DJ, et al. Pembrolizumab as Second-Line Therapy for Advanced Urothelial Carcinoma. *N Engl J Med*. 2017;376(11):1015-1026. doi:10.1056/NEJMoa1613683
17. Apolo AB, Ballman KV, Sonpavde G, et al. Adjuvant Pembrolizumab versus Observation in Muscle-Invasive Urothelial Carcinoma. *N Engl J Med*. 2025;392(1):45-55. doi:10.1056/NEJMoa2401726
18. Burtness B, Harrington KJ, Greil R, et al. Pembrolizumab alone or with chemotherapy versus cetuximab with chemotherapy for recurrent or metastatic squamous cell carcinoma of the head and neck (KEYNOTE-048): a randomised, open-label, phase 3 study. *Lancet*. 2019;394(10212):1915-1928. doi:10.1016/S0140-6736(19)32591-7
19. Uppaluri R, Haddad RI, Tao Y, et al. Neoadjuvant and Adjuvant Pembrolizumab in Locally Advanced Head and Neck Cancer. *N Engl J Med*. 2025;393(1):37-50. doi:10.1056/NEJMoa2415434

20. Rini BI, Plimack ER, Stus V, et al. Pembrolizumab plus Axitinib versus Sunitinib for Advanced Renal-Cell Carcinoma. *N Engl J Med*. 2019;380(12):1116-1127. doi:10.1056/NEJMoa1816714
21. Choueiri TK, Tomczak P, Park SH, et al. Overall Survival with Adjuvant Pembrolizumab in Renal-Cell Carcinoma. *N Engl J Med*. 2024;390(15):1359-1371. doi:10.1056/NEJMoa2312695
22. Marabelle A, Le DT, Ascierto PA, et al. Efficacy of Pembrolizumab in Patients With Noncolorectal High Microsatellite Instability/Mismatch Repair-Deficient Cancer: Results From the Phase II KEYNOTE-158 Study. *J Clin Oncol*. 2020;38(1):1-10. doi:10.1200/JCO.19.02105
23. Kojima T, Shah MA, Muro K, et al. Randomized Phase III KEYNOTE-181 Study of Pembrolizumab Versus Chemotherapy in Advanced Esophageal Cancer. *J Clin Oncol*. 2020;38(35):4138-4148. doi:10.1200/JCO.20.01888
24. Sun JM, Shen L, Shah MA, et al. Pembrolizumab plus chemotherapy versus chemotherapy alone for first-line treatment of advanced oesophageal cancer (KEYNOTE-590): a randomised, placebo-controlled, phase 3 study. *Lancet*. 2021;398(10302):759-771. doi:10.1016/S0140-6736(21)01234-4
25. Cortes J, Cescon DW, Rugo HS, et al. Pembrolizumab plus chemotherapy versus placebo plus chemotherapy for previously untreated locally recurrent inoperable or metastatic triple-negative breast cancer (KEYNOTE-355): a randomised, placebo-controlled, double-blind, phase 3 clinical trial. *Lancet*. 2020;396(10265):1817-1828. doi:10.1016/S0140-6736(20)32531-9
26. Pusztai L, Denkert C, O'Shaughnessy J, et al. Event-free survival by residual cancer burden with pembrolizumab in early-stage TNBC: exploratory analysis from KEYNOTE-522. *Ann Oncol*. 2024;35(5):429-436. doi:10.1016/j.annonc.2024.02.002
27. Makker V, Colombo N, Casado Herráez A, et al. Lenvatinib plus Pembrolizumab for Advanced Endometrial Cancer. *N Engl J Med*. 2022;386(5):437-448. doi:10.1056/NEJMoa2108330
28. O'Malley DM, Bariani GM, Cassier PA, et al. Pembrolizumab in Patients With Microsatellite Instability-High Advanced Endometrial Cancer: Results From the KEYNOTE-158 Study. *J Clin Oncol*. 2022;40(7):752-761. doi:10.1200/JCO.21.01874
29. Colombo N, Dubot C, Lorusso D, et al. Pembrolizumab for Persistent, Recurrent, or Metastatic Cervical Cancer. *N Engl J Med*. 2021;385(20):1856-1867. doi:10.1056/NEJMoa2112435
30. Monk BJ, Colombo N, Tewari KS, et al. First-Line Pembrolizumab + Chemotherapy Versus Placebo + Chemotherapy for Persistent, Recurrent, or Metastatic Cervical Cancer: Final Overall Survival Results of KEYNOTE-826. *J Clin Oncol*. 2023;41(36):5505-5511. doi:10.1200/JCO.23.00914
31. Lorusso D, Xiang Y, Hasegawa K, et al. Pembrolizumab or placebo with chemoradiotherapy followed by pembrolizumab or placebo for newly diagnosed, high-risk, locally advanced cervical cancer (ENGOT-cx11/GOG-3047/KEYNOTE-A18): a randomised, double-blind, phase 3 clinical trial. *Lancet*. 2024;403(10434):1341-1350. doi:10.1016/S0140-6736(24)00317-9
32. Rha SY, Oh DY, Yañez P, et al. Pembrolizumab plus chemotherapy versus placebo plus chemotherapy for HER2-negative advanced gastric cancer (KEYNOTE-859): a multicentre, randomised, double-blind, phase 3 trial. *Lancet Oncol*. 2023;24(11):1181-1195. doi:10.1016/S1470-2045(23)00515-6
33. Janjigian YY, Kawazoe A, Bai Y, et al. Pembrolizumab plus trastuzumab and chemotherapy for HER2-positive gastric or gastro-oesophageal junction adenocarcinoma: interim analyses from the phase 3 KEYNOTE-811 randomised placebo-controlled trial. *Lancet*. 2023;402(10418):2197-2208. doi:10.1016/S0140-6736(23)02033-0
34. Casak SJ, Kumar V, Song C, et al. FDA Approval Summary: Durvalumab and Pembrolizumab, Immune Checkpoint Inhibitors for the Treatment of Biliary Tract Cancer. *Clin Cancer Res*. 2024;30(16):3371-3377. doi:10.1158/1078-0432.CCR-24-0517
35. Park CS, Sung MJ, Kim SJ, et al. Prognostic Factors in Patients Treated with Pembrolizumab as a Second-Line Treatment for Advanced Biliary Tract Cancer. *Cancers (Basel)*. 2022;14(17):4323. Published 2022 Sep 3. doi:10.3390/cancers14174323