Written By: Michelle Hoa, PharmD
Natasha Heimbigner, PharmD
Summit Cancer Centers

Positive Quality Intervention: Vaccination for Non-Transplant Patients with Cancer

Description: Patients undergoing cancer treatment are more susceptible to infections due to their compromised immune system. This PQI will review which vaccinations cancer patients can or cannot use for the proper protection against preventable infections.

Background: Cancer treatments weaken the immune system rendering it more susceptible to infections.[1] In order to prevent these infections, cancer patients can either take antimicrobial prophylaxis, get vaccinated, or avoid contact with germs. Generally, it is best to get vaccinated prior to the start of cancer therapy. Live vaccines should be administered at least four weeks prior to the start of chemotherapy and/or at least 3 months after completion of treatment.[1,3] Inactive vaccines should be administered 2 weeks prior to the start of therapy for maximal effect, however, they can be given during therapy. Patients vaccinated during chemotherapy treatment with an inactive vaccine should consider revaccination at least 3 months after therapy as they could be rendered ineffective.[3]

PQI Process:

- Obtain patient vaccination history and reference with CDC recommendations to ensure they are current
- Determine type of vaccination chemotherapy patient needs
    - Non-replicating (inactive) vaccines: should be given at least *2 weeks* before the initiation of chemotherapy or other immunosuppressive therapy to maximize immune response[1]
        - Vaccination, 2 weeks prior to chemotherapy, allows for immune response against the targeted pathogen
        - Antibody response is suboptimal if given vaccination during immunosuppressive therapy but is better than not vaccinating; repeat vaccination or boosters may be beneficial in prolonging immunity[1,4]
    - Replicating live vaccines: should be given at least *4 weeks* prior to and at least *3 months* after immunosuppressive therapy[1]
        - Live vaccinations contain a weak *live* version of the virus; an immunocompromised system will not be able to fight against the pathogen (may cause vaccine-derived infections)
        - An adequate immune response usually occurs *3 to 12 months* after the completion of treatment; wait at least 3 months after the completion of therapy to receive live vaccinnes[5]
        - Vaccination should be delayed for at least *6 months after* treatment if the patient is receiving anti-B-cell antibodies[2]
    - Based on regimen, reference the package insert for all oncolytic specific vaccination suggestions

Patient-Centered Activities:

- If patient has **not** been vaccinated, counsel patient on the importance of vaccination
- Immunocompromised patients are at higher risk for certain diseases; additional vaccines are recommended[4]
    - TIV and polysaccharide-based vaccines (PCV, PPV, MCV4, MPSV, and Hib vaccines)[8]
    - Flu vaccine
        - **Do NOT** get nasal mist flu vaccine since it is a live vaccine
        - Influenza-related hospitalization is 3 to 5 times higher in cancer patients
    - Pneumococcal vaccine (PCV13 and PPV23)
        - Immunocompromised patients should receive PCV13 and then receive PPV23 vaccine about 8 weeks later;[7,8] then receive a second dose of PPV23 5 years after the first PPV23[8]

        - Patients that received at least one dose of PPV23 should receive PCV13 no sooner than 1 year after last PPV23 dose[8]
        - Help patients fight off serious lung, blood, or brain bacterial infections[7]
        - Recommended in multiple myeloma, lung cancer, chronic lymphocytic leukemia, and lymphoma[1]
    - Shingrix®
        - Shingrix® is an inactivated recombinant vaccine that is now FDA recommended in immunocompromised patients[9]
        - Immunocompromised patients should receive two doses of Shingrix regardless of previous history of shingles or previous receipt of zoster vaccine live (ZVL, Zostavax)
        - The second dose of Shingrix should be given 2-6 months after the first
        - For patients who would benefit from completing the series in a shorter period, the second dose can be administered 1-2 months after the first dose
        - If the second dose of Shingrix is given < 4 weeks after the first, repeat second dose at least 4 weeks after the dose that was given too early
    - COVID-19 Vaccine[12]
        - Moderna – three doses, 4 weeks apart
        - Pfizer-BioNTech – three doses total: 2nd dose given 3 weeks after 1st dose and 3rd dose given at least 4 weeks after 2nd dose
        - Johnson and Johnson – two doses, 4 weeks apart
    - COVID –19 Booster[12]
        - Moderna & Pfizer-BioNTech - Immunocompromised patients should receive a booster dose (fourth shot) at least 3 months after the third dose; followed by a second booster (fifth shot) at least 4 months after the first booster dose
        - Johnson and Johnson – Immunocompromised patients should receive a booster dose (third shot) at least 2 months after the second dose; followed by a second booster dose (fourth shot) using Moderna or Pfizer-BioNTech vaccines, at least 4 months after the first booster dose
- Counsel patients who are on immunotherapy on vaccination recommendations and precautions
    - Immunotherapy has variable immunomodulatory or immunosuppressive effects
    - Vaccine may be triggering an exaggerated immune response in certain patients[1]
        - Reports suggest that influenza vaccines given to patients on certain types of immunotherapies triggered an amplified immune-related adverse reaction[10,11]
        - Some patients receiving immune checkpoint inhibitors experienced intensified immune response[11]
    - Consult with prescriber if vaccination is appropriate with current immunotherapy
- Follow up with patient 3 months after chemotherapy is complete
    - If patient had inactive vaccine during treatment, remind to revaccinate 3 months post-treatment
    - If patient is over 65 or has an altered immune system, the CDC recommends a flu vaccine every year and pneumonia vaccine (PPSV23) every 5 years; PCV13 vaccine should only be given once
    - Booster Tdap vaccination should be considered for patients who have completed chemotherapy[1]
- Counsel family on risk of receiving live vaccines around patients undergoing chemotherapy

References:

1. Ariza-Heredia, Ella J, and Roy F Chemaly. "Practical Review of Immunizations in Adult Patients with Cancer." Human Vaccines & Immunotherapeutics 11.11 (2015): 2606–2614.
2. www.nccn.org/patients/resources/life_with_cancer/managing_symptoms/infections.aspx.
3. https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5515a1.htm.
4. Centers for Disease Control and Prevention. Recommendations of the advisory committee on immunization practices (ACIP): Use of vaccines and immune globulins in persons with altered immunocompetence. Morbidity and Mortality Weekly Report. 1993;42(RR-4).
5. https://www.medscape.com/viewarticle/413557.
6. http://chemocare.com/.
7. https://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/infections/vaccination-during-cancer-treatment.html.
8. https://www.pharmacytimes.com/news/cdc-committee-high-risk-adults-should-get-2-pneumococcal-vaccines.
9. https://www.cdc.gov/shingles/vaccination/immunocompromised-adults.html
10. https://www.cancernetwork.com/oncology-journal/immunizing-cancer-patients-which-patients-which-vaccines-when-give.
11. https://www.pharmaceutical-journal.com/news-and-analysis/news/influenza-vaccine-may-cause-exaggerated-immune-response-in-patients-on-cancer-immunotherapy/20202682.article?firstPass=false.
12. https://www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/low-blood-counts/infections/covid-19-vaccines-in-people-with-cancer.html

Supplemental Information: Vaccination Flow Chart:

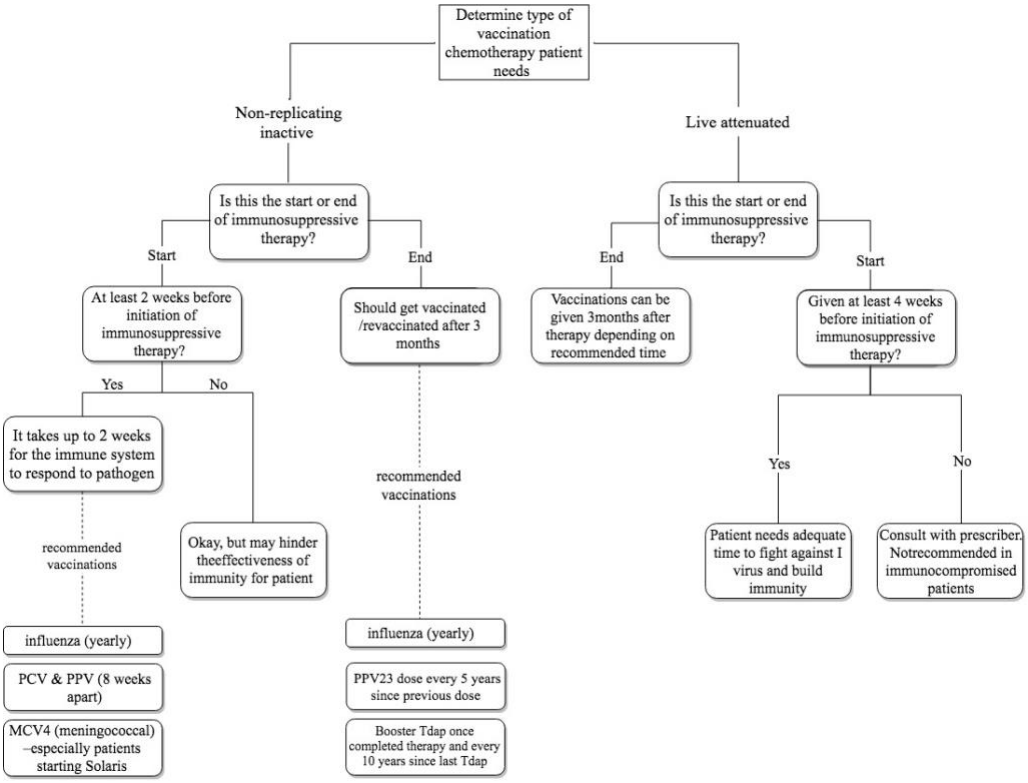

Table 1: Types of Vaccines

Type of Immunization	Principle of Action	Examples	Comments
Non-replicating vaccines	Based on toxoid, protein subunits, bacterial, antigens, or immunogenic proteins obtained with recombinant, technology.	Tetanus, diphtheria, pertussis, poliomyelitis, hepatitis B, influenza, varicella zoster (shingles) (Shingrix®), Hemophilus influenza, pneumococcus, meningococcus, COVID-19	Usually requires 3–5 doses; antibody titers diminish with time
Replicating live vaccines	Produced by disabling the virulent properties of a disease-producing virus or bacterium	Measles-mumps-rubella, varicella (chicken pox), intranasal influenza, yellow fever, oral polio, oral typhoid	Severe reactions are possible; transmission of live pathogen may occur; most provide immunity with 1 dose
Passive immunization	Antibodies are infused to provide short-term protection	Varicella Immunoglobulin, hepatitis B immunoglobulin	Protection diminishes after weeks or months