Lymphoma Treatment with Pacific Yew and Pokerooot

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Abstract

Pacific yew (Taxus brevifolia) and pokerooot (Phytolacca decandra) are two botanicals that have indications as anticancer agents, antiinflammatory substances, and immune stimulants. The anticancer effects of Pacific yew and pokerooot are due to many constituents in each herb, including taxanes, flavonoids, and lignans found in Pacific yew and saponins, tannin, astragalin, and protein PAP-R found in pokerooot. In the author's current case study, a patient with lymphocytic lymphoma/chronic lymphocytic leukemia followed a daily regimen of the two botanicals: (1) Pacific yew, using capsules with 600 mg of ground leaves from T. brevifolia and taking five capsules twice daily (Bighorn Montana Botanicals, Noxon, Montana) and (2) pokerooot, using a 1:2 fresh P. decandra root tincture in alcohol and water and taking 2 tsp twice daily (Herbalist & Alchemist, Washington, New Jersey). The first author, a naturopathic doctor, followed the patient for 3 years of therapy with follow-up visits occurring every 1 to 3 months during the first year of therapy. After 3 years of supplementation, the patient's white blood cell count increased from 3.3 x 10^9 cells/L to 8.5 x 10^9 cells/L; her absolute neutrophil count increased from 0.5 x 10^9 cells/L to 1.15 x 10^9 cells/L; and her atypical lymphocytes decreased from 8% to 0%. The author's case report suggested that these plants, consumed as crushed leaves in the case of Pacific yew and as a tincture in the case of pokerooot, may have a clinical benefit for lymphoma patients, resulting in improved survival and quality of life.

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For the United States in 2010, the National Cancer Institute (NCI) at the National Institutes of Health has estimated that $263.8 billion represents the combined direct and indirect medical and other costs associated with cancer. The American Cancer Society (ACS) has estimated that 1,529,560 new cancer cases and 569,490 deaths due to cancer occurred in the United States in 2010. The ACS also has estimated that lymphoma accounted for 74,030 (4.8%) of the new cancer cases in 2010. Categories of lymphoma include Hodgkin's lymphoma (HL) and non-Hodgkin's lymphoma (NHL). According to the ACS, in 2010 HL accounted for 8490 new cases and NHL for 65,540, and lymphoma accounted for 3.8% of all deaths due to cancer in the United States, with the majority of these lymphoma deaths due to HL. NCI has estimated that the costs associated with lymphoma in the United States are upwards of $10 billion annually. B-cell lymphoma is a type of cancer arising during B-cell lymphocyte development. B-cell lymphoma usually occurs in adults and may be either indolent or aggressive. Initiation of B-cell development occurs in primary lymphoid organs, with B-cell differentiation occurring in secondary lymphoid tissues (eg, lymph nodes, spleen, or tonsils). Critical processes in B-cell development, in which the occurrence of abnormalities may give rise to lymphomas, include (1) DNA modifications due to V(D)J recombination, a process of genetic recombination occurring in the early stages of production of T-cell receptors or immunoglobulin, which occurs in bone marrow; (2) somatic hypermutation; and (3) class switch recombination. Two of the last two processes occur in secondary lymphoid tissues.

B-cell lymphomas may be genetic or due to environmental factors, immunodeficiency, viruses, and connective tissue disorders. Researchers do not understand the causes of lymphoma entirely; however, major risk factors for NHL include immune deficiencies such as HIV/AIDS, autoimmune diseases, and chronic infections such as Epstein-Barr virus.

Reed-Sternberg cells characterize HL. These cells are atypical lymphoid cells and in most cases are B-cells. Hauke and Armitage estimated the age-adjusted incidence rate of lymphoma from 2004 to 2008 to be 22.7 per 100,000 individuals per year. Males have a higher rate of incidence than females, and whites have a higher incidence than other races, with the rates for blacks being second and Hispanics third. The estimated age-adjusted death rate was 7.3 per 100,000 men and women per year, based on patients who died in between 2003 and 2007 in the United States.

Types of Lymphomas

Hodgkin's Lymphoma

The presence of Hodgkin's Reed-Sternberg cells marks HL, which is a cancer of the immune system. Two major types of HL exist: classical and nodular (lymphocyte-predominant HL). Enlargement of lymph nodes, spleen, or other immune tissue; fever; weight loss; and fatigue or night sweats often are signs of HL. Researchers have evaluated several risk factors and have shown them to play a role in treatment outcome. For HL, the International Prognostic Index includes seven risk factors that
decrease the likelihood of a positive outcome: (1) male gender, (2) an age of 45 years or older, (3) stage IV disease; (4) albumin < 4.0 g/dL, (5) hemoglobin < 10.5 g/dL, (6) elevated white blood cell (WBC) count of 1.5 x 104/mL, and (7) low lymphocyte count, <600 mg/dL or less than 8% of total WBC. The presence of five or more risk factors is associated with a disease control rate of 42%, whereas the presence of one or the absence of any of these risk factors is associated with a 77% and 84% rate of disease control, respectively. Disease control, in the case of lymphoma, is defined as a tumor that no longer appears to be growing. The 5-year survival rate for HL after treatment is greater than 80% for adults and greater than 90% for children; it is one of the most curable cancers.3

Non-Hodgkin’s Lymphoma

NHLs are a group of cancers of white blood cells (lymphocytes) that can occur at any age. Enlarged lymph nodes, fever, and weight loss often mark them. Many types of NHL exist, with the diseases being divided into indolent and aggressive types that are formed from either B-cells or T-cells. B-cell lymphomas account for 80% to 90% of all NHLs. B-cell NHLs include (1) Burkitt lymphoma, (2) chronic lymphocytic leukemia (CLL)/small lymphocytic lymphoma (3) diffuse, large B-cell lymphoma, (4) follicular lymphoma, (5) immunoblastic large-cell lymphoma, (6) precursor B-lymphoblastic lymphoma, and (7) mantle cell lymphoma. Lymphomas occurring after bone marrow or stem cell transplantation are usually B-cell NHLs.

Prognosis and treatment depend on the stage and type of disease.4 For NHL, the International Prognostic Index includes five risk factors that decrease the likelihood of a positive outcome: (1) an age >60 years, (2) stage III or IV disease, (3) high lactate dehydrogenase, (4) more than one extranodal site, and (5) poor performance status (a measure of general health). Three risk categories exist concerning these five risk factors: (1) one risk factor = low risk, (2) two to three risk factors = intermediate risk, and (3) four to five risk factors = poor risk, with 5-year survival rates of 70%, 49% to 50%, and 26%, respectively.5 The outlook for NHL has improved due to refinements in and more aggressive approaches to therapy.

TREATMENTS

Medical practitioners usually treat HL with chemotherapy, radiation, or stem-cell or bone-marrow transplants or with a combination of these treatments, and they usually treat NHL with chemotherapy or radiation and infrequently, with a combination of chemotherapy and radiation.1 Additionally, current research focuses on novel compounds that target oncogenic signaling pathways and specific antigens in patients with lymphoma. B-cell lymphoma targets include, but are not limited to, apoptosis-signaling pathways involving caspase and CD19, CD20, and CD40 antigens.6

Current chemotherapeutic drugs used in the treatment NHL include (1) ABVD (doxorubicin [Adriamycin®], bleomycin, vinblastine, and dacarbazine); (2) CHOP (combination of cyclophosphamide, doxorubicin hydrochloride, vincristin, and prednisone); (3) CVP (cyclophosphamide, vincristin, and prednisone); (4) etoposide, which medical practitioners often use in a regimen called EPOCH (etoposide, prednisone, vincristine, cyclophosphamide, and doxorubicin), and (5) fludarabine, which medical practitioners may use in chemotherapy regimens such as FAD (fludarabine, doxorubicin, and dexamethasone) and FMD (fludarabine, mitoxantrone, and dexamethasone) and which may be more effective when used in combination with the monoclonal antibody rituximab.3,7

Cancer treatment no longer focuses only on elimination of cancer cells by inducing apoptosis; rather, research is focusing on other strategies, including targeting the tumor’s microenvironment and modulating the chronic inflammation associated with cancer or immunomodulation. Plants are a source of diverse phytochemicals with numerous biological effects. Pacific yew (Taxus brevifolia) and pokeweed (Phytolacca decandra) are two plant species with numerous constituents that have demonstrated anti-cancer and anti-inflammatory activities in vitro and in vivo.

**Taxus brevifolia (Pacific Yew)**

Practitioners of traditional non-Western medicine and of alternative medicine have used various Taxus spp for indications that include cancer and tumor suppression (eg, T caputdeta used in traditional Chinese medicine). Practitioners traditionally steep yew needles as tea. Not until the discovery of paclitaxel did researchers investigate Pacific yew for its potential in cancer therapy. Anecdotal reports have mentioned improved quality of life in over 2000 cancer patients, including lymphoma patients, due to consumption of Pacific yew teas (4-6 cups daily) and capsules (six-eight 300-mg capsules per day); however, it is important to note that the reports did not disclose the concomitant therapies and dietary habits of the patients.6

Pacific yew contains several constituents for which researchers have reported in vitro and in vivo anticancer properties (eg, taxanes, flavonoids [quercetin, rhamnetin, and sciodipytis] and lignins [laricresinol and taxiresinol]).8,12 Taxanes. This group of anticancer agents, found exclusively in plants of the genus Taxus (yew), inhibits cell division through disruption of microtubule function, which is essential in mitosis.6 In 1971, MC Wani and colleagues isolated Paclitaxel (Taxol), a taxane, from the bark of T brevifolia (Pacific yew), and the drug is now approved by the US Food and Drug Administration as a chemotherapeutic drug. Due to shortages of Paclitaxol, researchers have generated semisynthetic analogues such as docetaxel.

**Flavonoids.** This group of plant pigments elicits antioxidant activity. In vitro studies have demonstrated that the flavonoid quercetin provides activity against some forms of cancer.11 The mechanism of action is not yet understood but may be due to its antioxidant or anti-inflammatory properties. Studies have suggested that quercetin may slow the growth of cancer cells and may lead to apoptosis of the cells.12 Furthermore, researchers tested preparations of dried leaf, dried cortex, and dried twig of T brevifolia in vitro and reported that all preparations demonstrated 99% inhibition of leukemia L1210 cells when challenged with a concentration of 1.0 parts per million.15

**Lignans.** Many plant species contain lignans, and researchers have reported that this class of phytoestrogens exhibits a number
of pharmacological effects, such as antioxidant, anticancer (apoptosis and tumor-growth suppression), and antiinflammatory effects.\textsuperscript{10} Chattopadhyay et al have reported on the anticancer activity of lignans of another member of the genus Taxus, \textit{T. wallitchiana} (Himalayan yew).\textsuperscript{11} They tested three lignans (taxiresinol, isolatexiresinol, and (-)secoisolariciresinol) to determine their anticancer potential using six cancer cell lines: ovarian (PA-1), breast (MCF-7), colon (COLO 320DM and CaCo-2), oral (KB-403), and liver (WRL). These researchers found that the lignan taxiresinol demonstrated anticancer activity against the colon, breast, ovary, and liver cancer cell lines.\textsuperscript{11}

Though in vitro and in vivo studies do not always translate easily to clinical effects in humans, it is important to consider that Pacific yew has many constituents that may act synergistically in cancer therapy. Use of Pacific yew, however, requires clinical studies that can allow researchers to draw firm conclusions about the benefits of its herbal preparations as therapeutic agents in cancer and to understand fully its mechanism(s) of action.

\textbf{Phytolacca decandra (Pokeroot)}

Pokeroot (\textit{P decandra}), also known as pokeweed, is a member of the \textit{Phytolaccaceae} family and is native to North America. Researchers have reported antitumor, antiinflammatory, and immunostimulating functions for pokeweed. Practitioners of alternative medicine have used pokeweed as a medicinal substance to remove toxins from the body and restore overall health. These practitioners have used small amounts of dried root to treat skin diseases, arthritis and joint pain, inflammation, and skin and breast cancer.\textsuperscript{26} In homeopathic medicine, practitioners use pokeweed dilutions, including the parent compound (mother tincture) and prescribe daily doses of 60 mg to 100 mg of dried roots in oral human therapy.\textsuperscript{27} Pokeroot’s use in treating cancer dates back to the 18th century. More recently, in vitro and in vivo studies have demonstrated that pokeweed is effective as an anticancer agent; however, researchers have not yet conducted clinical studies to verify its potential role in cancer therapy.\textsuperscript{18,19}

Constituents of pokeweed that researchers have identified include pentacyclic triterpenes and triterpene saponins (including oleanolic acid), protein PAP-R, and mitogen.\textsuperscript{12,20-22} \textbf{Pentacyclic Triterpenes and Triterpene Saponins.} A wide variety of plant species contain pentacyclic triterpenes and their glycosides (triterpene saponins), with a higher incidence in dicotyledons compared to monocotyledons, where their presence is rare.\textsuperscript{23} Research on pentacyclic triterpenes and triterpene saponins derived from plants has demonstrated diverse biological activities, most notably antitumor, antiviral, antiinflammatory, and immunomodulatory activities.\textsuperscript{24,25} Oleanolic acid belongs to a group of oleanane-type triterpenes, and researchers have shown it to have anticancer potential against PGCL3 human lung carcinoma cells; MCF-7 breast cancer cells; human colon cancer cells (HT-29); HL-60 human leukemia cells; and human B cell lymphoma cell line, P3HR1.\textsuperscript{26,27} Other groups of triterpenes include squalene, lanostane, dammarane, lupine, ursane, and hopane.\textsuperscript{24} Many triterpene and triterpene saponins belonging to these groups have demonstrated anticancer and antiinflammatory properties in vitro. Most notably, ursolic acid (belonging to the ursane group of triterpenes) and betulinic acid (belonging to the lupane group of triterpenes) have demonstrated anticancer and antiinflammatory properties.\textsuperscript{25,26} Scientists have researched ursolic acid extensively and shown it to be apoptotic to numerous cancer-cell lines, including human leukemia cancer HL-60; human colon cancer HT-29; human breast cancer MCF-7; human melanoma M4Bee; and human Burkitt’s lymphoma Daudi cells.\textsuperscript{37} Furthermore, researchers have reported that oleanolic acid inhibits nuclear factor kappa-light-chain-enhancer of activated B cells (NF-kB) activation, thus functioning as an antiinflammatory agent.\textsuperscript{36,38,39} NF-kB is a potential target for triterpenes as it is responsible for modulating other proteins, including tumor necrosis factor-alpha, interleukin-8, and cyclooxygenase-2.\textsuperscript{26,28} Karin et al have reported that the signaling pathways involved in the activation of NF-kB are important for tumor development; targeting NF-kB may have both antiinflammatory and anticancer effects.\textsuperscript{36}

\textbf{Protein PAP-R.} In in vivo trials, researchers have used an investigational biotherapeutic agent derived from pokeweed, B43 (anti-CD19) antiviral protein (PAP) immunotoxin, and found it to have antileukemic activity when combined with the chemotherapeutic drug cytoxin arabinoside. CD19 has become a target for immunotoxins and other immunotherapeutic agents. The CD19 antigen is expressed during differentiation of the hematopoietic stem cell and continues to be expressed through pro-B cell and mature B-cell differentiation. During terminal differentiation into plasma cells, CD19 is downregulated. B-cells that have undergone neoplastic transformation maintain CD19 expression. Anti-CD19 monoclonal antibodies coupled to biological toxins have proven to be effective in the treatment of NHL and leukemia in vitro and in vivo.\textsuperscript{41,42} Furthermore, in a Phase 1 clinical trial conducted in children with relapsed leukemia, treatment with B43 (anti-CD19) PAP immunotoxin, in combination with other chemotherapeutic agents, led to complete remission in 10 of the 15 participants evaluable for response (66.7%), and partial remission in two children (13.3%).\textsuperscript{43}

\textbf{Mitogen.} In the case of CLL, researchers have found an accumulation of lymphocytes arrested at an intermediate stage of B-cell development. Numerous in vitro studies have demonstrated that pokeweed mitogen is an immune modulator, stimulating both T-cell and B-cell lymphocytes, suggesting that stimulation of B-cell proliferation in CLL may have beneficial effects.\textsuperscript{44,45}

\textbf{TOXICITY PROFILES OF POKEROOT AND PACIFIC YEW}

Researchers know that both pokeweed and yew have toxic characteristics. The toxicity of pokeweed is due to the saponin glycosides and proteinaceous mitogens present (ie, phytolaccatoxin and phytolaccagenin). The potential for gastrointestinal irritation—including nausea, vomiting, cramping, abdominal pain, diarrhea, and burning sensation in mouth and throat—is attributable to the presence of the saponin glycosides. Other reported side effects include weakness, tachycardia, difficulty breathing, salivation, urinary incontinence, severe thirst, drowsiness, and respiratory failure.\textsuperscript{46} Research also has raised concerns for hematologic changes, such as plasmacytosis, eosinophilia, thrombocytopenia, and abnormal platelet morphology.\textsuperscript{47} It is important to note that pokeroottinctures are usually available only through
licensed health-care professionals due to their potential toxicity, and patients should take them under supervision.

Reportedly, the toxicity seen in the *Taxus* spp (yew) is due to the taxane-derived alkaloids, taxane-derived substances (eg, taxol A and B), and glycosides present in the seeds, bark, and leaves of the plant. Adverse effects include gastrointestinal effects, including nausea, vomiting, and abdominal pain; tachycardia; dizziness; bradycardia; respiratory paralysis; and death. The estimated lethal dose of taxines is between 3.0 mg and 6.5 mg per kg of body weight (equivalent to approximately 0.6 g to 1.3 g of leaves) or approximately 45 g to 100 g of leaves for an average body weight of 75 kg. *T. baccata* and *T. cuspidata* more commonly contain taxines, and the needles of *T. brevifolia* contain them at very low levels.48,50

**CASE STUDY**

The following case study illustrates the potential role of Pacific yew and pokerooot in the treatment of B-cell lymphoma.

In 2008, HF was an 86-year-old man, and his primary care doctor had referred him to an oncologist for evaluation of leukopenia. HF was a nonsmoker, rarely consumed alcohol, and denied exposure to any chemical toxins or radiation. On referral to the oncologist, HF had a WBC count of 3.3 x 10⁹ cells/L, hemoglobin of 131 g/L, and a platelet count of 153 x 10⁹/L. His blood differential showed an absolute lymphocyte count of 0.5 x 10⁹/L. Three weeks later, blood work showed a drop in WBC count to 2.8 x 10⁹ cells/L, in hemoglobin to 129 g/L, and in platelets to 173 x 10⁹/L. As well as an absolute neutrophil count of 480 x 10⁹/L. Lymphocyte counts were in the low range of normal at 1.3 x 10⁹/L. Folic acid, ferritin, glycated hemoglobin, iron, iron-binding capacity, and vitamin B12 were all within the normal range.

The patient complained of fatigue, which he called low energy. He denied having any fever, chills, sweats, cough, or pleuritic-type chest pain and had not had any problems with infections. He had dyspnea on exertion, but this condition was stable, and he denied any angina, palpitations, abdominal pain, nausea, vomiting, diarrhea, constipation, or edema of extremities. In 2008 upon diagnoses, the patient reported a bump in the inguinal area that had been present for about 5 years, which he described as variable. In 2008 upon diagnosis, his medical practitioner determined it to be a ventral hernia. The patient believed he had had a weight loss of approximately 12 lbs over the prior 3 years.

**Medical and Family History**

The patient’s previous medical history included type 2 diabetes, coronary artery disease, atherosclerosis, and osteopenia. His mother and father both had colon cancer, but no family history of hematologic malignancies existed.

**Lymph Node Examination**

Examination of his cervical, supraclavicular, axillary, and shotty lymph nodes biopsy was negative for cancer. The oncologist found very small nodes (which, if less than 0.5 cm, are questionable) in the bilateral inguinal areas. The oncologist found multiple lymphadenopathy with all nodes measuring about 1 cm or less. The nodes were not confluent and were movable but not tender.

**Assessment**

The patient had lymphadenopathy in the bilateral inguinal areas. The oncologist did not note an enlarged spleen or liver. Differential diagnosis included large granulocytic leukemia, which is akin to chronic lymphoid leukemia, a stage of small lymphocytic lymphoma. Bone marrow aspirates showed that he had a lymphoproliferative disorder, CD20 positive and CD5 positive. That phenotypic profile is most consistent with small lymphocytic lymphoma/CLL, although he did not have lymphocytosis. The computed tomography scan of the abdomen and pelvis showed abundant lymphadenopathy, all about 1 cm to 2 cm. The oncologist found nothing bulky obstructing or causing any immediate symptoms or damage to organs. The practitioner’s assessment was small lymphocytic lymphoma with marrow involvement.

**Therapy and Outcome**

The oncologist did not recommend chemotherapy due to the patient’s age but did recommend immunotherapy. As the patient enjoyed travelling and wanted to continue his current lifestyle, he did not want to enter a hospital due to the potential risk of infection with immunotherapy. The oncologist did not recommend cytotoxic therapy due to the risk of infections, cardiac toxicity, and uropathy. The practitioner did recommend a course of rituximab and discussed the side effects—such as chills, sweats, suppression of lymphocytes, and immunocompromization—with the patient. Research has shown that rituximab leads to increased rates of infections in patients with some forms of lymphoma.51 As the patient had a history of success using naturopathic medicine and did not want to change his lifestyle, he opted for a natural course of therapy. Furthermore, the patient’s naturopathic doctor (Michael Friedman, ND, first author of this article) had had previous success using herbal medicine, which included pokerooot, with two patients who had stage IV liver melanoma.52

The patient started taking pokerooot (2 tsp twice daily) 2 months after diagnosis on the advice of his naturopath. The naturopath added Pacific yew (five capsules twice daily) to the dosing regimen for the last 6 months of treatment.

Pokerooot (Herbalist & Alchemist, Washington, New Jersey) was a 1:2 fresh *P. decandra* root tincture in alcohol and water. Pacific yew (Bighorn Montana Botanicals, Noxon, Montana) was provided as capsules containing approximately 600 mg of ground *T. brevifolia* leaves dissolved in alcohol and water. The dosage was based on previous success in ocular melanoma metastatic to the liver and experience with the aforementioned botanicals.52

A physical examination by the patient’s physician 5 months after the initial referral revealed that the nodes below the inguinal ligament appeared to be larger by palpation; however, the practitioner noted no lymphadenopathy in other parts of the patient’s system. After 2 years of treatment, the nodes below the inguinal ligament appeared to be smaller by palpation.

The oncologist and or naturopath conducted hematology every 1 to 3 months following diagnosis for the first year and again after 2 years of supplementation. After 10 months of supplementation, the patient’s WBC count increased to 4.9 x 10⁹ cells/L (normal) and continued to show improvement through 2 years of supplementation. After 3 years, the patient’s WBC count increased to

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8.5 x 10^9 cells/L, meaning it more than doubled from the time the patient started therapy (Figure 1). Absolute neutrophil count increased from 0.5 x 10^9 cells/L to 1.15 x 10^9 cells/L (data not shown), and atypical lymphocytes decreased from 8% to 0% during this period (Figure 2).

At the time of diagnosis, the patient complained of fatigue and malaise and an inability to gain weight. Four months after starting treatment with pokeroat, the patient’s fatigue and malaise were 70% less, and the patient had gained 5 lbs. The patient was also able to go on a 10-mile hike, demonstrating an increase in quality of life. Eleven months into treatment, the patient complained of muscle weakness, and his neurologist diagnosed him with low dopamine levels; as a result, the neurologist prescribed dopamine. Sixteen months after initiating treatment, the patient still felt malaise but felt better than prior to initiation of herbal treatment; he was able to hike for 5 miles and swim for 1 hour without rest. Thirty-one months after start of treatment, the patient had a sinus infection; his energy increased after the infection cleared up but he had only enough energy for small hikes. The oncologist stated that the patient was doing remarkably well, and blood tests indicated no progression of disease. These conclusions indicated that the patient needed no further bone marrow biopsies.

The oncologist supported the herbal treatment after he saw that the WBC count returned to normal levels, and the atypical lymphocytes decreased. The patient did not take any drugs or undergo immunotherapy but was on a low-sugar diet and occasionally used other herbs. Dieticians generally encourage patients with lymphoma to follow a diet low in red meat and processed foods and to increase intake of fish, legumes, fruits, vegetables, and whole grains. The patient in this case study was on a low-sugar diet prior to and during the treatment period and did not change his diet during treatment.

The naturopath noted that atypical lymphocytes would increase when the patient stopped taking the pokeroat for more than 1 week (Figure 2); thus, pokeroat was essential to the patient’s recovery. The patient currently continues to take pokeroat and Pacific yew.

CONCLUSION

Though survival rates for NHL have improved over recent years, researchers are seeking alternative therapies because patients with an intermediate or poor level of risk have high mortality. The addition of other chemotherapeutic regimens, use of immunotoxins, or combinations thereof for NHL may improve survival rates further; however, these regimens may not be suitable for all candidates, especially for those with other underlying medical conditions and for those prone to infection. Such cases require novel therapeutics with fewer side effects and with no immune-suppressing effects. This article has presented a case for the potential of pokeroat and Pacific yew in the treatment of lymphoma, where daily supplementation resulted in remission for over 2.5 years. The patient required continuous monitoring due to the high potential for relapse in patients with lymphoma. In vitro and in vivo studies have shown that the
constituents in Pacific yew and pokoot have anticancer and immunomodulatory effects. Although such studies do not always mimic the results in the human body, the mechanistic evidence is important in understanding the clinical evidence. The current case study suggests that these plants, consumed as a tincture in the case of pokeroot and as crushed leaves in the case of Pacific yew, may have clinical benefits to lymphoma patients, resulting in improved survival and quality of life. The progression toward a cure for this often terminal disease warrants further research on these products. Due to the toxic nature of these plants, the authors advise caution and close monitoring of patients’ general health and hematology.

REFERENCES