

Cancer survivorship

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THE STORY IN ONE SENTENCE

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“Survivorship is not just 'watching and waiting' — it is active medical care for the long-term effects of treatment and the ongoing risk of cancer.”

Normal anatomy — the body's job

Normally, after an illness or injury, the body repairs itself completely — organs bounce back, energy returns, and life goes on. The immune system patrols constantly, destroying any abnormal cells before they can grow into cancer. Hormones flow steadily from glands, nerves carry signals smoothly, the heart pumps strongly, and the lungs stretch and fill with air easily. Keep that picture in your head, because survivorship is what happens when treatment leaves behind damage that does not fully heal.

BODY'S JOB

The immune system is supposed to catch and kill stray cancer cells. The heart is supposed to pump blood to every organ. The lungs are supposed to stretch and grab oxygen from the air. Glands (like the thyroid, ovaries, and testes) are supposed to make hormones that control energy, mood, growth, and sex. Nerves are supposed to carry signals without pain. The brain is supposed to think clearly and remember. All of these jobs depend on healthy cells, and cancer treatment — while it kills cancer — also damages some of these healthy cells.

1. The immune system patrols the body every day, looking for abnormal cells and destroying them before they can multiply.
2. Glands release hormones into the bloodstream, which travel to organs and tell them how to work (like turning up energy, building muscle, or triggering sex drive).
3. The heart pumps oxygen-rich blood to every tissue, feeding them so they can do their jobs.

4. The lungs pull oxygen from the air into the blood and push carbon dioxide (waste gas) out.
5. Nerves send messages from the brain to the body and back, letting you feel, move, and control your organs.
6. The brain processes information, stores memories, and regulates mood and focus.
7. When all these systems work together, you feel normal — energized, clear-headed, and healthy.

What breaks

Cancer treatment is designed to kill fast-growing cancer cells, but it also damages some normal cells that were just in the way. Chemotherapy poisons dividing cells (including healthy ones in the bone marrow, gut, nerves, and heart). Radiation burns tissue (including healthy tissue near the tumor). Surgery removes tissue (sometimes taking nerves, blood vessels, or glands with it). The body tries to heal, but some damage is permanent. Scar tissue replaces healthy tissue. Organs work less well. And because cancer treatment also damages DNA, there is a risk of new cancers starting years later. On top of physical damage, survivors live with fear and uncertainty, which can lead to depression, anxiety, and trouble sleeping.

CLINICAL TERM

Cancer survivorship encompasses the ongoing risk of recurrence, second primary malignancies, and chronic toxicities from chemotherapy, radiation, and surgery. Chemotherapy-induced cardiotoxicity (especially from anthracyclines), pulmonary fibrosis (from bleomycin or thoracic radiation), peripheral neuropathy (from platinum agents, taxanes, or vinca alkaloids), cognitive impairment (chemo brain), endocrine dysfunction (hypothyroidism, hypogonadism, infertility), and psychosocial after-effects (sequelae) (depression, anxiety, post-traumatic stress) are all well-documented. Surveillance for recurrence and screening for treatment-related second cancers (such as therapy-related myelodysplastic syndrome or acute myeloid leukemia, and radiation-induced solid tumors) are essential components of survivorship care per ASCO and NCCN guidelines.

How the body compensates

The body tries hard to keep things stable even when organs are quietly failing. The heart speeds up to make up for weak pumping. The lungs breathe faster to grab more oxygen. The kidneys hold onto salt and water to keep blood pressure up. Adrenaline (the body's fight-or-flight hormone) stays high to prop up energy. This can make vital signs and labs look okay for a long time — until suddenly the system cannot keep up anymore and everything crashes at once. The danger in survivorship is that serious problems (like heart failure, cancer

recurrence, or severe depression) can be brewing silently for months or years before they become obvious. The job is to catch these problems early, when they are still fixable.

1. For months or years after treatment, survivors may feel tired or off but not know why. Vital signs and routine labs often look normal because the body is compensating.
2. The heart may pump faster to make up for weaker muscle. The lungs may breathe faster to get enough oxygen into stiffening tissue. The adrenal glands may pour out stress hormones to keep energy up.
3. This is the dangerous middle — survivors and doctors may think everything is fine because nothing looks dramatically wrong yet, but the body is already working overtime just to stay stable.
4. The crash point comes when compensation fails: the heart cannot pump fast enough anymore and fluid backs up into the lungs (heart failure). The lungs cannot stretch anymore and oxygen levels drop dangerously (respiratory failure). Hormone levels fall so low that the patient becomes profoundly weak or confused (adrenal crisis or severe hypothyroidism). Cancer comes back and spreads before anyone notices. Depression becomes so severe that the patient cannot function or thinks about suicide.
5. Watch for early warning signs before the crash: worsening fatigue that rest does not fix, new shortness of breath or leg swelling, worsening neuropathy pain, new lumps or masses, unexplained weight loss, persistent cough, changes in bowel or bladder habits, mood or memory getting worse, or loss of interest in things that used to matter.
6. The window to intervene is wide if you catch things early — heart failure can be managed with medications like ACE inhibitors and beta blockers, lung fibrosis progression can be slowed with antifibrotics and oxygen, hormones can be replaced with thyroid hormone pills or testosterone or estrogen, second cancers can be caught when they are still small and curable, and mental health can be treated with therapy and medications like SSRIs. But once the system tips into crisis, the window closes fast and outcomes are much worse.
7. Survivorship care plans (recommended by ASCO and NCCN) include regular monitoring for late effects, surveillance imaging and labs for recurrence, screening for second cancers, and mental health support — precisely because the goal is to catch problems early, not wait for the crash.

Domino effect

1. Cancer treatment damages healthy cells throughout the body while killing cancer cells. — Chemotherapy, radiation, and surgery are not perfectly precise — they target fast-growing or localized tissue, but they also hit nearby healthy organs and tissues, leaving behind injury and scar tissue.

2. Organs that were damaged by treatment cannot work as well as they used to, so the body has less reserve to handle stress or normal demands. — For example, a heart weakened by doxorubicin cannot pump as hard during exercise. Lungs scarred by bleomycin or chest radiation cannot expand fully to grab oxygen. Glands destroyed by radiation or chemo cannot make the hormones the body needs to feel normal.
3. Survivors feel exhausted all the time (fatigue), even after rest, because their organs are working overtime just to keep up with basic daily tasks. — When the heart, lungs, glands, and blood cells are all running below normal capacity, the body never has enough oxygen, energy, or hormones to feel strong. Every activity — even getting dressed or walking to the mailbox — takes more effort than it should.
4. Nerves that were poisoned by chemotherapy fire pain signals constantly, causing burning, tingling, or stabbing pain in the hands and feet (peripheral neuropathy). — Chemotherapy drugs like cisplatin, paclitaxel, and vincristine damaged the long nerve fibers that run from the spinal cord to the hands and feet. Those damaged nerves misfire, sending pain signals even when nothing is actually hurting the skin. The damage is often permanent because nerve fibers grow back very slowly or not at all.
5. The heart muscle weakens over months to years after anthracycline chemotherapy (like doxorubicin or daunorubicin), leading to heart failure (shortness of breath, leg swelling, and feeling like the heart is racing). — Anthracyclines poison the mitochondria (the power plants inside heart muscle cells), causing those cells to die. The heart tries to compensate by pumping faster, but eventually it cannot keep up, and fluid backs up into the lungs and legs.
6. Lungs become stiff and scarred after bleomycin or chest radiation, making it harder and harder to breathe deeply or exercise (pulmonary fibrosis). — The treatment triggered inflammation in the lungs, and the body tried to heal by laying down scar tissue. But scar tissue does not stretch like normal lung tissue, so over time the lungs lose their ability to expand and oxygen levels drop.
7. Glands that make hormones (thyroid, ovaries, testes, pituitary) stop working after radiation or chemotherapy, leaving the body without the chemical signals it needs to control energy, mood, sex, and growth (endocrine dysfunction). — Radiation aimed near these glands or chemotherapy drugs that circulate through the whole body killed the cells that make hormones. Without thyroid hormone, the metabolism slows down and the patient feels cold, tired, and depressed. Without sex hormones like estrogen and testosterone, energy, mood, bone strength, and sexual function all decline.

8. Thinking becomes slow and foggy, memory gets worse, and focus is hard to maintain (chemo brain or cognitive impairment). — Chemotherapy and radiation injured neurons in the brain, reduced blood flow to the brain, and triggered inflammation. The hippocampus (the part of the brain that stores new memories) and the prefrontal cortex (the front part of the brain that controls focus and planning) are especially vulnerable, so survivors struggle with tasks that used to be easy.
9. Depression, anxiety, fear of recurrence, and trouble sleeping become chronic problems for many survivors. — The trauma of cancer and treatment rewires the brain's fear and stress circuits. The amygdala (the brain's alarm center) stays on high alert, and the prefrontal cortex (which calms things down) becomes less effective. Stress hormones like cortisol stay high. Living with uncertainty about whether cancer will come back is exhausting and isolating, and many survivors feel abandoned once active treatment ends.
10. Cancer can come back (recurrence) or a completely new cancer can start (second primary malignancy), sometimes years after treatment ends. — Even after treatment, microscopic clusters of cancer cells can hide in the body and start growing again months or years later. On top of that, chemotherapy and radiation damage DNA in healthy cells, and sometimes that damage leads to a new cancer — like leukemia or myelodysplastic syndrome after alkylating chemo or topoisomerase inhibitors, or solid tumors like lung or breast cancer after chest radiation. This is why surveillance (regular scans, exams, and labs) is a core part of survivorship care.

Symptoms · what the patient feels, and why

- Fatigue that does not go away with rest: Cancer treatment—chemotherapy, radiation, or surgery—damages healthy cells alongside cancer cells. Chemotherapy can lower red blood cell counts (anemia), which means less oxygen reaches muscles and organs, like a car engine running on thin air. Radiation and surgery trigger inflammation (the body's repair alarm), and healing that damage drains energy for months or even years. The bone marrow (the factory inside bones that makes blood cells) may also recover slowly, keeping energy low long after treatment ends.
- Pain in bones, joints, or muscles: Chemotherapy and hormone treatments (like aromatase inhibitors for breast cancer or androgen blockers for prostate cancer) pull calcium out of bones, making them weaker and achy—like old, brittle wood. Radiation leaves scar tissue in muscles, joints, and connective tissue, which stiffens and hurts when you move. Some drugs (platinum-based chemo, taxanes) also irritate nerves directly, sending pain signals even after the drug is gone.

- Memory problems or trouble focusing (sometimes called 'chemo brain'): Chemotherapy and radiation can injure brain cells and the insulation (myelin) around the wires (axons) that let brain cells talk to each other—like frayed phone cables that drop calls. Treatment also triggers inflammation in the brain and lowers levels of brain-derived neurotrophic factor (BDNF), a protein that helps grow and protect brain cells. Fatigue, stress hormones (cortisol), and sleep problems after cancer pile on, making it even harder to remember or concentrate.
- Numbness, tingling, or burning in hands or feet (peripheral neuropathy): Certain chemotherapy drugs—platinum drugs (cisplatin, oxaliplatin), taxanes (paclitaxel, docetaxel), and vinca alkaloids (vincristine)—damage the long nerves that run from the spine out to fingers and toes. They strip away the protective myelin coating and poison the nerve's power plant (mitochondria), so signals get scrambled or lost. The result is tingling, burning, numbness, or sharp pain in a stocking-and-glove pattern. Nerves heal very slowly—sometimes an inch per month—and some damage may be permanent.
- Shortness of breath or new cough: Radiation to the chest scars the delicate air sacs (alveoli) and tissue between them (interstitium), making the lungs stiff and less stretchy—like a dried-out sponge that cannot expand. This is called pulmonary fibrosis. Some chemotherapy drugs (bleomycin, methotrexate, nitrosoureas) also poison lung cells directly. In addition, anthracycline chemo (doxorubicin, daunorubicin) and chest radiation can weaken the heart muscle (cardiomyopathy), so the heart cannot pump blood forward efficiently; blood backs up into the lungs, causing fluid buildup (pulmonary swelling (edema)) and breathlessness.
- Chest pain, fast heartbeat, or irregular heartbeat: Anthracycline chemotherapy (doxorubicin, epirubicin) and chest radiation damage the heart muscle cells (cardiomyocytes) by creating toxic free radicals (unstable molecules that tear apart cell parts) and harming the mitochondria (the cell's battery). The heart muscle weakens and cannot squeeze as hard, a condition called cardiomyopathy. Radiation also scars the arteries feeding the heart (coronary artery disease) and can stiffen the sac around the heart (pericardium), all of which cause chest pain, skipped beats, or a racing feeling.
- New lumps, bumps, or sores that do not heal: Cancer can come back in the same spot (local recurrence) or in a new area (metastasis or second primary cancer). Radiation damages DNA in healthy cells, and years later a few of those cells can turn cancerous—this is called a radiation-induced second malignancy. Any new, growing, or non-healing growth must be checked quickly with imaging or biopsy to rule out cancer returning or a brand-new cancer starting.

- Anxiety, sadness, or intense fear about cancer coming back: Surviving cancer is a trauma. The person has faced the real possibility of dying and endured painful, exhausting treatments. Even after treatment ends, the brain's alarm center (the amygdala) stays on high alert, scanning the body for any sign cancer is back. Every ache, every follow-up scan, every anniversary of diagnosis can trigger a flood of stress hormones (cortisol, adrenaline) and fear. This heightened vigilance—called fear of recurrence—is a normal emotional response to a life-threatening experience, though it can become overwhelming without support.
- Weight gain or weight loss without trying: Hormone treatments (like tamoxifen, aromatase inhibitors, androgen deprivation therapy) slow metabolism and increase appetite, leading to weight gain. Steroids (dexamethasone, prednisone) given during chemo also drive hunger and shift fat to the belly. On the flip side, some survivors lose weight from ongoing nausea, changes in taste and smell (from chemo damaging taste buds), depression that kills appetite, or undiagnosed thyroid problems after neck radiation. Sudden, unexplained weight loss can also signal cancer recurrence.
- Trouble sleeping (insomnia): Cancer treatment disrupts the body's internal clock (circadian rhythm) and lowers melatonin (the brain hormone that signals sleep time). Worry, pain, hot flashes from hormone therapy, and steroids all interfere with sleep. The hippocampus (the brain's memory and sleep regulator) may also be damaged by chemo or radiation, making it harder to fall asleep or stay asleep. Poor sleep then worsens fatigue, pain, and mood, creating a vicious cycle.

Focused exam

- Fatigue that does not go away after rest: After cancer treatment, this kind of tiredness means the body is still dealing with damage from chemotherapy, radiation, or surgery. It is not laziness — it is a real sign that organs, nerves, or the brain need help. It affects daily life and can point to heart, lung, nerve, thyroid, or mental health problems that need checking.
- Fast heart rate at rest or shortness of breath with light activity: Chemotherapy drugs called anthracyclines (doxorubicin, daunorubicin) and chest radiation can scar the heart muscle over time. A scarred heart cannot squeeze hard enough to pump blood well, so the body does not get enough oxygen. This heart weakness can show up months or even years after treatment ends and can be deadly if missed.
- Dry cough or trouble breathing that started months or years after chest radiation or bleomycin chemotherapy: Radiation to the chest and the chemotherapy drug bleomycin can scar the lungs. Scarred lungs cannot stretch well to let air in, so the body does not get enough oxygen. This makes patients feel tired and short of breath even with small tasks. It is called pulmonary fibrosis (lung scarring).

- Numbness, tingling, or burning pain in hands and feet: Chemotherapy drugs like platinum agents (cisplatin, oxaliplatin), taxanes (paclitaxel, docetaxel), and vinca alkaloids (vincristine) damage the nerves that run to the hands and feet. This is called peripheral neuropathy (damaged outer nerves). Damaged nerves send pain signals or make it hard to feel or move fingers and toes, which wears the body out and causes fatigue.
- Swelling in one arm or leg, especially on the side where lymph nodes were removed or radiated: Surgery to remove lymph nodes or radiation to the lymph node area can block the flow of lymph fluid (the clear fluid that drains waste from tissues). The fluid backs up and swells the arm or leg. This is called lymphedema. The body works harder to move the heavy limb, which drains energy and causes fatigue.
- Low mood, trouble remembering things, poor concentration, or difficulty sleeping: Cancer treatment can change how the brain works — chemotherapy damages nerve connections, chronic stress floods the hippocampus (the brain's memory center) with cortisol (the body's main stress hormone), and fear of the cancer coming back keeps the amygdala (the brain's alarm center) turned on high. This is called chemo brain or cancer-related cognitive impairment. A tired, worried brain cannot signal the body to rest well, so fatigue gets stuck in place.

Diagnostics · every test answers a question

- Echocardiogram (ultrasound of the heart) → Is the heart pumping well, or did chemotherapy or radiation weaken it?
- Troponin blood test → Is the heart muscle being damaged right now?
- Pulmonary function test (PFT) — spirometry and diffusing capacity (DLCO) → Can the lungs take in air and move oxygen into the blood normally?
- Thyroid-stimulating hormone (TSH) blood test → Is the thyroid gland making enough hormone, or did radiation or chemotherapy damage it?
- Complete blood count (CBC) → Are red blood cells, white blood cells, and platelets at normal levels?
- Vitamin B12 and folate levels → Are vitamin levels normal, or is the body missing nutrients that make red blood cells and nerve coverings?
- Cancer surveillance imaging (mammogram, CT, or PET scan, depending on the original cancer type) → Is the cancer coming back, or is there a new cancer?
- Lipid panel (cholesterol, triglycerides) and fasting glucose or hemoglobin A1c → Did cancer treatment cause diabetes, high cholesterol, or other metabolic damage?

Treatment logic

- Survivorship care plan — a written document listing the cancer type, all treatments received (chemo drugs, radiation dose and field, surgeries), expected late effects, and a schedule for screening and follow-up → Gives the patient and all their doctors a clear map of what happened and what to watch for. It tells you which organs were hit and when to check them, so nothing gets missed. Guidelines (ASCO, NCCN) say every survivor should get one.
- Cardiology screening with echocardiogram, troponin, and EKG — done within 1 year after finishing treatment if anthracyclines (doxorubicin, daunorubicin) or chest radiation were used, then every 1–2 years → Finds heart weakening before the patient feels short of breath or their legs swell. If caught early, ACE inhibitors (like lisinopril) or beta-blockers (like carvedilol) can slow the damage and prevent full heart failure.
- Pulmonary function testing and chest CT if bleomycin or mediastinal (middle-chest) radiation were used → Catches lung scarring before it steals too much oxygen. Tells you which patients need supplemental oxygen or limits on heavy activity. Helps avoid infections that scarred lungs cannot fight.
- Hormone screening — TSH for thyroid, testosterone or estrogen depending on sex, and growth hormone or cortisol if the pituitary (the brain's hormone control center) was radiated — checked based on radiation field and patient age → Replaces hormones that radiation or chemotherapy destroyed. Fixing low thyroid or sex hormones improves energy, strengthens bones, lifts mood, and restores sexual function.
- Neuropathy treatment with gabapentin (a nerve-pain blocker) or duloxetine (an antidepressant that also quiets nerve pain); compression garments and physical therapy for lymphedema → Quiets the pain signals from damaged nerves so patients can sleep and use their hands. Moves lymph fluid out of swollen limbs so the arm or leg feels lighter and works better.
- Mental health referral (therapy, antidepressants like sertraline or escitalopram if needed) and fatigue management — sleep hygiene coaching, graded exercise prescription (starting slow and adding small amounts each week), and nutritionist support → Treats the tiredness, anxiety, and sadness by fixing sleep, slowly rebuilding muscle strength, and improving nutrition. Gives the patient hope and a plan to get their life back week by week. Serotonin (a brain messenger that steadies mood and sleep) is boosted by antidepressants.
- Financial navigation and social work support — help with insurance, disability applications, transportation, and medication costs → Removes money and logistics barriers so patients can actually get to appointments, afford medicines, and focus on healing instead of drowning in bills.

Medications

ACE inhibitors (e.g., lisinopril) or ARBs (e.g., losartan) · ACE inhibitor or Angiotensin receptor blocker

These medicines lower blood pressure and shield the heart muscle from getting stiff or weak after certain cancer treatments (like doxorubicin or trastuzumab) damaged it. They block a hormone called angiotensin that squeezes blood vessels tight and makes the heart work harder.

1. Cancer drugs (especially anthracyclines like doxorubicin or HER2 blockers like trastuzumab) can hurt heart cells and weaken the heart's pumping power.
2. The body releases a hormone called angiotensin II that normally controls blood pressure by squeezing blood vessels.
3. ACE inhibitors stop the body from making angiotensin II. ARBs block angiotensin II from grabbing onto receptors (like blocking a key from a lock).
4. Blood vessels relax, blood pressure drops, and the heart doesn't have to push as hard.
5. This gives damaged heart muscle time to rest and may stop more damage from happening.

SAFETY WATCH

Can cause a dry cough that won't go away (more common with ACE inhibitors). · Can raise potassium in the blood too high, especially if kidneys aren't working well. · Can cause dizziness or lightheadedness when you stand up. · Should not be used during pregnancy because it can harm the baby. · Kidney function and potassium levels need to be checked with blood tests a few weeks after starting.

Beta-blockers (e.g., carvedilol, metoprolol) · Beta-adrenergic blocker

These medicines slow the heart rate and lower blood pressure. They protect the heart from damage caused by certain chemotherapy drugs (like doxorubicin or trastuzumab) by blocking stress hormones (adrenaline and noradrenaline, the body's speed-up chemicals) that make the heart beat harder and faster.

1. Chemotherapy can weaken the heart muscle over time, especially drugs in the anthracycline family (like doxorubicin) or drugs that block HER2 (like trastuzumab).
2. Stress hormones (adrenaline and noradrenaline, made by the adrenal glands) normally make the heart beat faster and stronger by attaching to beta receptors on heart cells.
3. Beta-blockers sit on those beta receptors and block the stress hormones from attaching (like putting a cover over a lock).
4. The heart beats slower and with less force, so it uses less energy and oxygen.

5. This lowers the workload on a damaged heart and may prevent more injury.

SAFETY WATCH

Can make you feel very tired or dizzy, especially when you first start. · Can make asthma or COPD worse by tightening airways in some people. · Can hide the warning signs of low blood sugar in people with diabetes. · Heart rate and blood pressure need to be checked regularly. · Should not be stopped suddenly because that can cause a rebound spike in heart rate and blood pressure.

Statins (e.g., atorvastatin, rosuvastatin) · HMG-CoA reductase inhibitor (statin)

Statins lower cholesterol (a waxy fat) in the blood. Cancer survivors often have higher risk for heart disease because of radiation to the chest or certain chemotherapy drugs. Statins block the liver from making too much cholesterol, which helps prevent fatty buildup in arteries.

1. The liver makes cholesterol using an enzyme (a tiny worker protein) called HMG-CoA reductase.
2. Statins block that enzyme (like turning off a factory machine).
3. The liver makes less cholesterol.
4. The liver pulls more cholesterol out of the blood to make up for it.
5. Blood cholesterol (especially LDL, the 'bad' kind) goes down.
6. Lower cholesterol means less chance of fatty plaques building up in arteries and causing a heart attack or stroke.

SAFETY WATCH

Can cause muscle aches or weakness; rarely, severe muscle breakdown (rhabdomyolysis, a dangerous condition where muscle fibers break apart and clog the kidneys). · Can raise liver enzymes; liver tests should be checked before starting and during treatment. · Can interact with many other medicines, including some used in cancer treatment. · Grapefruit juice can make some statins stronger and increase side effects. · Should not be used during pregnancy.

Gabapentin or pregabalin · Anticonvulsant (seizure medicine, used here for nerve pain)

These medicines calm down nerves that are sending too many pain signals. Chemotherapy drugs (like platinum drugs, taxanes, or vinca alkaloids) can damage the coating on nerves,

causing tingling, burning, or shooting pain in the hands and feet (peripheral neuropathy, meaning nerve damage away from the brain and spinal cord).

1. Chemotherapy damages the protective coating (myelin, like insulation on a wire) around nerves or the nerve fibers themselves.
2. Damaged nerves send pain signals to the brain even when there's no injury happening.
3. Gabapentin and pregabalin attach to a part of nerve cells called the alpha-2-delta subunit on calcium channels (the gates that let calcium rush into nerve cells).
4. This blocks calcium from rushing into the nerve cell.
5. When less calcium gets in, the nerve releases fewer pain chemicals (like glutamate, an excitatory neurotransmitter).
6. Fewer pain signals reach the brain, so tingling and burning feel less intense.

SAFETY WATCH

Can cause dizziness, sleepiness, or trouble with balance, especially in older adults. · Can cause swelling in the feet or hands. · Should be started at a low dose and increased slowly. · Stopping suddenly can cause withdrawal symptoms; dose should be lowered gradually. · Pregabalin is a controlled substance because some people misuse it.

Duloxetine · Serotonin-norepinephrine reuptake inhibitor (SNRI)

Duloxetine helps with nerve pain and also low mood or anxiety. It raises two brain chemicals — serotonin (a messenger that steadies mood and sleep) and norepinephrine (a messenger that helps control pain signals and attention) — that help control both pain signals and feelings. It is one of the few medicines proven to reduce chemotherapy-caused nerve pain.

1. Chemotherapy damages nerves, causing them to fire pain signals even without injury.
2. Nerve cells normally release serotonin and norepinephrine, then suck them back up to reuse them.
3. Duloxetine blocks the pumps (transporters) that suck these chemicals back up (reuptake inhibitors).
4. Serotonin and norepinephrine stay in the space between nerve cells longer.
5. Higher levels of these chemicals dampen pain signals traveling up the spinal cord and also improve mood.
6. Pain feels less sharp, and feelings of sadness or worry may lessen.

SAFETY WATCH

Can cause nausea, dry mouth, or constipation, especially in the first few weeks. · Can raise blood pressure in some people. · Should not be stopped suddenly; the dose should be lowered slowly to avoid dizziness, headache, or feeling like you have the flu. · Should not be used with MAO inhibitors (another type of antidepressant) because of a dangerous drug interaction. · Rarely can increase thoughts of suicide, especially in young adults; mood should be watched closely when starting.

Compression therapy and exercise for lymphedema · Non-drug physical therapy

Lymphedema (swelling, usually in an arm or leg) happens when lymph nodes (small bean-shaped organs that filter fluid and fight germs) are removed or damaged during cancer surgery or radiation. Fluid that normally drains through lymph vessels (tiny tubes that carry clear liquid called lymph) gets stuck. Compression sleeves or stockings gently squeeze the limb to push fluid back toward the body. Specific exercises help pump the fluid along.

1. Surgery (like removing lymph nodes under the arm for breast cancer) or radiation can damage or block lymph vessels.
2. Lymph fluid (a clear liquid that carries waste and immune cells) can't drain normally and pools in the arm or leg.
3. A fitted compression garment applies steady, gentle pressure from the hand or foot up toward the shoulder or hip.
4. This pressure pushes fluid out of the tissues and into lymph vessels that are still open.
5. Exercises (like gently opening and closing the hand, or walking) act like a pump to move fluid along.
6. Manual lymph drainage (a special type of gentle massage done by a trained therapist) can also help guide fluid toward working lymph nodes.

SAFETY WATCH

Compression garments must fit correctly; too tight can block circulation, too loose doesn't help. · Skin must be watched for redness, warmth, or pain, which could mean infection (cellulitis, a serious infection that spreads fast in people with lymphedema). · Avoid blood pressure cuffs, needle sticks, or tight jewelry on the affected limb. · Keep skin clean and moisturized to prevent cracks that let bacteria in. · See a certified lymphedema therapist for a personalized plan.

Methylphenidate or modafinil · Stimulant (methylphenidate) or wakefulness-promoting agent (modafinil)

Cancer-related fatigue is exhaustion that doesn't get better with rest. It may be caused by leftover effects of chemotherapy, radiation, low blood counts, hormone changes, sleep problems, or depression. These medicines increase alertness by raising certain brain chemicals — dopamine (a messenger that drives motivation and attention) and norepinephrine for methylphenidate; modafinil works through less well-understood pathways, possibly affecting histamine (a wakefulness signal) and orexin (a brain chemical that keeps you awake).

1. Cancer treatment, ongoing stress, and the body's healing process can leave you feeling deeply tired even after treatment ends.
2. Methylphenidate blocks the reuptake of dopamine and norepinephrine in the brain, so these 'wake up' chemicals stay active longer.
3. Modafinil works in a less well-understood way, possibly increasing histamine and orexin in brain regions that promote wakefulness.
4. Both medicines help you feel more alert and able to focus during the day.
5. They don't fix the root cause of tiredness but can make daily activities easier while other treatments (like exercise, sleep hygiene, or treating anemia) take effect.

SAFETY WATCH

Methylphenidate is a controlled substance and can be misused; it can raise heart rate and blood pressure. · Both medicines can cause trouble sleeping if taken too late in the day. · Can cause headache, nervousness, or loss of appetite. · Should be used carefully in people with heart problems, high blood pressure, or a history of anxiety. · Regular follow-up is needed to make sure the medicine is helping and not causing harm.

Testosterone replacement (for men) or vaginal estrogen (for women) · Hormone replacement

Many cancer treatments lower sex hormones. Chemotherapy, radiation to the pelvis, or surgery can damage the ovaries (where women make estrogen and progesterone) or testicles (where men make testosterone). Low testosterone in men causes low energy, low sex drive, and erection problems. Low estrogen in women causes vaginal dryness and pain during sex. Replacing these hormones can ease symptoms.

1. Cancer treatment damages the ovaries or testicles, so they make less estrogen or testosterone.
2. In men, low testosterone causes tiredness, low mood, and trouble with erections.
3. Testosterone gel, patch, or injection replaces the missing hormone, which helps restore energy, mood, and sexual function.

4. In women, low estrogen makes the vaginal lining thin and dry, causing pain during sex.
5. Low-dose vaginal estrogen cream, tablet, or ring thickens the vaginal lining and increases moisture without raising estrogen levels in the whole body very much.
6. Sexual function and comfort improve.

SAFETY WATCH

Testosterone can raise red blood cell count too high, increase risk of blood clots, worsen sleep pauses in breathing (apnea), and possibly fuel prostate cancer growth; prostate-specific antigen (PSA, a blood test for prostate cancer) and blood counts must be checked regularly. · Vaginal estrogen is generally safe even in breast cancer survivors (because very little enters the bloodstream), but discuss with your oncologist first. · Systemic estrogen (pills, patches) is usually avoided in breast cancer survivors because it may increase the risk of cancer coming back. · Both hormones need to be prescribed and watched by a doctor familiar with cancer survivorship.

Selective serotonin reuptake inhibitors (SSRIs, e.g., sertraline, escitalopram) or SNRIs (e.g., venlafaxine) · Antidepressant

Depression and anxiety are common after cancer treatment. These medicines raise serotonin (a brain messenger that steadies mood, sleep, and appetite) — and norepinephrine (a messenger that helps control attention and pain signals) in SNRIs — in the brain. This helps improve mood, lower worry, and make it easier to sleep and eat normally.

1. Stressful experiences (like cancer diagnosis and treatment) can lower serotonin, a brain chemical that helps regulate mood.
2. SSRIs block the pump (transporter protein) that sucks serotonin back into nerve cells after it is released.
3. SNRIs block reuptake of both serotonin and norepinephrine.
4. More serotonin (and norepinephrine) stays in the space between nerve cells.
5. Over a few weeks, this helps nerve circuits in the brain work better, lifting mood and easing anxiety.
6. Sleep, appetite, and energy often improve as well.

SAFETY WATCH

Can cause nausea, headache, or trouble sleeping in the first few weeks. · Can lower sex drive or make it harder to have an orgasm. · Should not be stopped suddenly; the dose should be tapered slowly to avoid dizziness, irritability, or flu-like symptoms. · Rarely can increase thoughts of suicide, especially in young adults; mood should be watched closely when starting. · Some SSRIs (like fluoxetine and paroxetine) can interfere with tamoxifen (a common breast cancer drug that blocks estrogen), so choice of antidepressant matters in breast cancer survivors.

Bisphosphonates (e.g., zoledronic acid, alendronate) or denosumab · Bone-protecting agent

Some cancer treatments (like aromatase inhibitors for breast cancer or androgen deprivation therapy for prostate cancer) weaken bones and raise the risk of fractures (broken bones). Bisphosphonates and denosumab slow down the cells (osteoclasts, the bone-dissolving cells) that break down bone, helping bones stay stronger.

1. Bones are always remodeling: cells called osteoclasts break down old bone, and cells called osteoblasts build new bone.
2. Hormone therapies for cancer tip the balance so that more bone is broken down than rebuilt, making bones thin and fragile (osteoporosis, weak and porous bones).
3. Bisphosphonates stick to bone surfaces and are taken up by osteoclasts.
4. Inside osteoclasts, bisphosphonates shut down the machinery the cell needs to dissolve bone.
5. Denosumab works differently: it blocks a signal (RANKL, a protein that tells the body to make more osteoclasts) that tells the body to make more bone-dissolving cells.
6. Both medicines slow bone loss, keep bones denser, and lower the chance of fractures.

SAFETY WATCH

Can cause flu-like symptoms (fever, aches) after the first dose, especially with intravenous bisphosphonates. · Rarely can cause osteonecrosis of the jaw (the bone in the jaw dies), especially after dental work; see a dentist before starting and keep good oral hygiene. · Can cause low calcium in the blood; calcium and vitamin D supplements are usually given at the same time. · Bisphosphonates can irritate the esophagus (the tube from throat to stomach) if not taken correctly (must sit upright for 30 minutes after taking a pill). · Denosumab is given as a shot every 6 months; stopping it suddenly can cause a rebound increase in bone breakdown and fractures, so it should not be stopped without a plan.

Red flags

- New or growing lump, especially in an area where cancer was treated before
- Sudden shortness of breath or chest pain at rest
- Coughing up blood or severe new cough that does not go away
- Unexplained weight loss—more than 10 pounds in a few months without trying
- Severe headache with vision changes, confusion, weakness on one side of the body, or trouble speaking
- Persistent fever without an obvious infection
- Bone pain that wakes you at night or gets worse over time

Nursing priorities

1. Assess vital signs including heart rate, rhythm, blood pressure, oxygen saturation, and respiratory rate; listen to lung sounds for crackles or wheezing and heart sounds for murmurs or extra beats. — Anthracycline chemotherapy and chest radiation damage the heart muscle and pericardium (sac around the heart), causing heart failure (fluid backs up into lungs), arrhythmias, and valve disease; crackles in lungs signal fluid overload, low oxygen means the heart is not pumping well, and irregular pulse may indicate atrial fibrillation (an irregular, quivering heartbeat) or other dangerous rhythm that needs immediate EKG and cardiology consult.
2. Screen for signs of recurrence or new cancer by asking about new lumps, unexplained weight loss, persistent pain, bleeding, or cough; examine any area of concern and escalate positive findings to the provider immediately. — Cancer survivors have higher risk of the original cancer coming back (recurrence) and developing second primary cancers due to genetic factors, prior radiation damaging DNA, and immune system changes; early detection through surveillance improves survival because smaller tumors respond better to treatment and have not spread to distant organs yet.
3. Perform a fall-risk assessment and check sensation in hands and feet by testing light touch, pinprick, and ability to feel vibration; ask if the patient has dropped objects or tripped recently. — Platinum chemo and taxanes damage peripheral nerves (nerves outside the brain and spinal cord), causing numbness and weakness that raises fall risk and injury; peripheral neuropathy can be permanent, so early physical therapy referral and home safety modifications like grab bars and removing loose rugs prevent fractures and head trauma.

4. Review the survivorship care plan with the patient, confirm they understand their cancer type, treatments received, and schedule for follow-up imaging, labs, and specialist visits; provide a written or electronic copy if they do not have one. — Survivorship care plans improve adherence to screening guidelines and help primary-care providers know what late effects to monitor; many survivors see multiple doctors who may not communicate well, so a written plan ensures nothing is missed and the patient can advocate for needed tests like annual mammogram after chest radiation or thyroid labs after neck radiation.
5. Screen for anxiety, depression, fear of recurrence, and post-traumatic stress using validated tools or direct questions; assess sleep quality, social support, and coping strategies. — Up to 45 percent of cancer survivors develop anxiety or depression due to fear of cancer returning, financial toxicity (debt from treatment), body-image changes, and loss of the close monitoring that happened during active treatment; untreated mental health problems worsen fatigue, pain, and immune function, so early referral to counseling or psychiatry improves quality of life and may even improve survival by increasing treatment adherence.
6. Educate the patient on cardiac protection strategies including limiting alcohol, avoiding NSAIDs like ibuprofen if heart function is reduced, controlling blood pressure and cholesterol, and reporting any new shortness of breath or leg swelling immediately. — Anthracyclines and chest radiation cause progressive heart damage that worsens over decades; NSAIDs (nonsteroidal anti-inflammatory drugs like ibuprofen and naproxen) cause fluid retention and raise blood pressure, stressing an already-weak heart; tight control of cardiovascular risk factors slows progression to heart failure and reduces risk of heart attack, which is higher in cancer survivors than the general population.
7. Check vaccination status and ensure the patient receives annual influenza vaccine, updated COVID-19 vaccines, and catch-up vaccines for pneumococcus, shingles, and others per CDC guidelines; confirm timing is safe if the patient is still immunosuppressed. — Some cancer treatments, especially stem-cell transplant and certain chemo drugs, weaken the immune system for months to years, raising risk of severe infections; live vaccines like shingles vaccine (Shingrix is non-live and safe) must be avoided until immune recovery, but inactivated vaccines like flu shot protect against preventable infections that could be fatal in immunocompromised survivors.
8. Teach energy-conservation techniques, encourage light physical activity like walking 20 to 30 minutes most days, and refer to physical therapy or occupational therapy if fatigue interferes with daily tasks. — Cancer-related fatigue persists in up to 40 percent of survivors due to anemia (low red blood cells), thyroid damage from radiation, deconditioning (loss of muscle from inactivity), and inflammation from treatment; exercise improves mitochondrial function (energy production in cells), boosts mood through endorphin release, and reduces fatigue better than rest alone, but must be gradual to avoid injury in deconditioned patients.

Sources

- NCCN Survivorship Guidelines 2024
- American Cancer Society Cancer Survivorship Care Guidelines
- American Society of Clinical Oncology (ASCO) Cancer Survivorship Compendium
- CDC Cancer Survivors Study

Last reviewed: 2026-07-07