

# Yoga for Bone Health in a Leukemia Patient

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## Foreword: by Leigh Leibel

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### **Background: Bone health during cancer treatment**

Cancer survivors are at high risk for local or generalized bone loss, bone fragility, and bone fractures due to the deleterious impact of metastases and disease on the skeleton and its structure, as well as the toxic effect of anti-cancer therapies on bone cells (Drake 2013). Treatments that contribute to this include chemotherapy, radiotherapy, glucocorticoids, aromatase inhibitors, and androgen deprivation therapy, among others. Bone loss caused by the various cancer therapies occurs at a faster and more severe rate than that caused by normal aging – reported to be seven times higher (Guise et al. 2006, Dalton 2019). Given this, osteoporosis in cancer populations is a prevalent and debilitating disease that contributes to impaired health-related quality of life, disability, and death.

In 2019, the American Society for Clinical Oncology (ASCO) issued *Clinical Practice Guidelines for the Management of Osteoporosis in Cancer Survivors*. In their recommendation, the panel says, "Clinicians should actively encourage patients to engage in a combination of exercise types, including balance training, flexibility or stretching exercises, endurance exercise, and resistance and/or progressive strengthening exercises, to reduce the risk of fractures caused by falls" (Shapiro et al. 2019). While ASCO guidelines acknowledge conflicting data as to whether exercise preserves bone density mass in cancer populations (as compared to healthy populations), they nonetheless recommend exercise in this population as a nonpharmacologic management intervention due to its known benefits to overall health, including improved sleep, mood, fitness, and a reduction in the risk of cancer recurrence and/or certain new cancers (Shapiro et al. 2019).

Weight-bearing and muscle-strengthening exercises are also recommended in the *Clinician's Guide to Prevention and Treatment of Osteoporosis* developed by multispecialty medical experts at the Bone Health and Osteoporosis Foundation (BHOFF) (known as the National Osteoporosis Society [NOS] until October, 2021). In their recommendations they name yoga, pilates, and tai chi as exercises to improve agility, strength, posture, and balance to reduce the risk of falls (Cosman et al. 2014).

As the importance of exercise on skeletal health in at-risk cancer populations is increasingly recognized by oncologists, more research on the impact of exercise (including postural yoga) on bone density in cancer survivors is warranted. Today, there

is still not enough research data to identify the most beneficial yoga poses for cancer survivors who are at risk for reduced bone density due to anticancer therapies, or to identify which yoga postures present the least risk for fracture or injury in this population. Research and literature on this subject exist (Sfeir et al. 2018, Smith & Boser 2013, Lu et al. 2016), but is not mutually conclusive. Standardization of future research and broad inclusive discussions are needed.

Widespread agreement exists that movements emphasizing flexion of the thoracic spine and extreme thoracic twists are contraindicated for those people with, or at risk for osteoporosis, whether due to aging or disease. There is also agreement that moderate weight-bearing activities are beneficial to strengthen the muscles supporting the spinal column, promote balance, improve posture, reduce risk of falls, and enhance quality of life (Chan et al. 2003, Papaioannou et al. 2010, Sinaki 2012a & b, Sinaki & Mikkelsen 1984). This is endorsed by the BHOF in their public-facing patient information (see Box 6.16). Well-designed empirical studies are needed to further the understanding of which yoga poses are of greatest benefit and present the least risk to people with cancer and survivors who have bone health issues.

Given the above, yoga therapists and yoga professionals must exercise caution when working with people with cancer and survivors who are confirmed to have osteoporosis or are known to be at risk of developing it. Yoga programs should be designed to address each patient/client's current bone health status and comorbid conditions. There are many benefits of a yoga practice in cancer populations, including improved posture, balance, gait, coordination, strength, and range of motion, as well as reduced anxiety – all of which contribute to the health and well-being of people with cancer and survivors (Galantino et al. 2012, Järvinen et al. 2008, Smith & Boser 2013, Prado et al. 2014, Salem et al. 2013, Payne & Crane- Godreau 2013, DiBenedetto et al. 2005).

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Cancer survivors are at high risk for local or generalized bone loss, bone fragility, and bone fractures due to the deleterious impact of metastases and disease on the skeleton and its structure, as well as the toxic effect of anticancer therapies on bone cells (Drake, 2013). Treatments that contribute to this include chemotherapy, radiotherapy, glucocorticoids, aromatase inhibitors, and androgen deprivation therapy, among others. Bone loss caused by the various cancer therapies occurs faster and is more severe than the bone loss caused by normal aging. In fact, it is said to be seven times higher (Guise et al., 2006). Given this, osteoporosis in cancer populations is a prevalent and debilitating disease that contributes to impaired health-related quality of life, disability, and death.

In 2019, the American Society for Clinical Oncology (ASCO) issued *Clinical Practice Guidelines for the Management of Osteoporosis in Cancer Survivors*. In their recommendation, the panel says, “Clinicians should actively encourage patients to engage in a combination of exercise types, including balance training, flexibility or stretching exercises, endurance exercise, and resistance

*and/or progressive strengthening exercises, to reduce the risk of fractures caused by falls.”* (Shapiro et al 2019). While ASCO guidelines acknowledge conflicting data as to whether exercise preserves bone density mass in cancer populations (as compared to healthy populations), they nonetheless recommend exercise in this population as a nonpharmacologic management intervention due to its known benefits to overall health, including improved sleep, mood, fitness, and a reduction in the risk of cancer recurrence and/or certain new cancers (Shapiro et al., 2019).

Weight-bearing and muscle-strengthening exercises are also recommended in the *Clinician's Guide to Prevention and Treatment of Osteoporosis* developed by multispecialty medical experts at the National Osteoporosis Foundation (NOF). In their recommendations they name yoga, pilates, and tai chi as exercises to improve agility, strength, posture, and balance to reduce the risk of falls (Cosman et al., 2014).

As the importance of exercise in skeletal health in at-risk cancer populations is increasingly recognized by oncologists, more research on the impact of exercise (including postural yoga) on bone density in cancer survivors is warranted. Today, there is still not enough research data to identify the most beneficial yoga poses for cancer survivors who are at risk for reduced bone density due to anticancer therapies, or to identify which yoga postures present the least risk in this population of fracture or injury. Research and literature on this subject (Sfeir et al., 2018; Smith and Boser 2013; Lu et al., 2016) exists, but is not mutually conclusive. Standardization of future research and broad inclusive discussions are needed.

Widespread agreement exists that movements emphasizing flexion of the thoracic spine and extreme thoracic twists are contraindicated for people with - or at risk for - osteoporosis, whether it's due to aging or disease. On the other hand, moderate weight-bearing activities are beneficial to strengthen the muscles supporting the spinal column, promote balance, improve posture, reduce risk of falls, and enhance quality of life (Chan et al., 2003; Papaioannou et al., 2010; Sinaki, 2012; Sinaki & Mikkelsen, 1984). This is supported by both the National Osteoporosis Society (NOS) and the National Osteoporosis Foundation (NOF) in their public facing patient information. Well-designed empirical studies are needed to further the understanding of which yoga poses are of greatest benefit and present the least risk to cancer survivors with bone health issues.

Given the above, yoga therapists and yoga professionals must exercise caution when working with cancer survivors who are confirmed to have osteoporosis or are known to be at risk of developing it. Yoga programs should be designed to address each patient/client's current bone health status and comorbid conditions. There are many benefits of a yoga practice in cancer populations, including better posture, improved balance, enhanced coordination, greater range of motion, higher strength, reduced levels of anxiety, and better gait - all of which contribute to the health and wellbeing of cancer patients and survivors (Gallantino et al., 2021; Järvinen et al., 2008; Smith & Boser, 2013; Prado et al., 2014; Mi et al., 2014; Salem et al., 2013; Payne and Crane-Godreau 2013; DiBenedetto et al., 2005).

**National Osteoporosis Foundation says on their website:**

*“If you have osteoporosis, you should avoid any movements that require you to bend forward from the waist, such as doing a toe touch. When you bend forward from the waist, your shoulders and back become rounded. This is also known as spine flexion and can increase the risk of a spine fracture. If you have osteoporosis or are otherwise at risk of breaking bones in your spine, you should avoid twisting to a point of strain.” (NOF).*

**National Osteoporosis Society says on their website:**

- Do not bend forward from the waist.
- Do not twist and bend at the torso (trunk) to an extreme.
- Do not lift/carry heavy object.
- Do not bend forward when coughing and sneezing.
- Do not reach for objects on a high shelf.
- Do not do toe-touches, sit-ups, or abdominal crunches.

**Client Story: Bryan**

*Bryan (he/his) is a 54-year-old white man diagnosed with acute lymphoblastic leukemia (ALL) and post-transplant graft-versus-host-disease (GVSD).*

Bryan is an acclaimed orthopedic surgeon who has led research on osteoporosis. He was diagnosed with acute lymphoblastic leukemia (ALL) after he was taken to the emergency room complaining of a rapid heart rate, shortness of breath, and a severe pounding headache. At time of diagnosis, he was physically fit, a life-long sports enthusiast, a proud father, and head surgeon at a local orthopedic center.

Upon diagnosis of ALL, Bryan immediately began a grueling six-month treatment protocol to prepare him for an allogeneic (donor) stem cell transplant. The induction phase consisted of six cycles of chemotherapy including significant doses of glucocorticoids, and a strong dose of radiation therapy. Once his disease was controlled, he received a pre-transplant dose of chemotherapy designed to eradicate any residual disease including his bone marrow stem cells. He then received an infusion of stem cells from a donor.

Four months after his transplant, Bryan began losing weight, and experienced gastrointestinal distress and musculoskeletal pain. Movement was extremely difficult, *“I felt like the Tin Man, grunting and moaning with the simplest movements.”* These symptoms lead to the diagnosis of chronic graft versus host disease (GVHD), a syndrome commonly associated with allogeneic stem cell transplant, which is characterized by inflammation of various body organs. GVHD happens when the donated tissue (graft) recognizes the recipient (host) as foreign and the donor's white blood cells in the transplanted tissue attack cells of the recipient's body.

As a result of GVHD, Bryan underwent ten months of treatment and was bed-ridden for weeks at a time. He consequently lost body mass and strength. During this time, he lost over 35 pounds or 23% of his total body weight and he struggled to engage in any type of physical activity. As an orthopedic surgeon, Bryan knew the long-term risks caused by his cancer treatments and his increased risk of developing glucocorticoid-induced osteoporosis. He also knew exercise supports bone health. But how could he exercise with his fragile physical circumstances? A friend suggested yoga.

Bryan was referred to me for yoga therapy by a mutual friend, and I worked with him over a six-week period. Each weekly yoga therapy session was 90-minutes. At our first session together, we thoroughly discuss his current health condition. He said his medical team had not ordered a DEXA scan (dual-energy x-ray absorptiometry) which is a measurement of bone density, even knowing his high risk of treatment-induced osteoporosis. Bryan and I prioritized safety and were extremely careful to protect his spine by selecting yoga poses that avoid stress on the spine which would increase the likelihood of breaking a bone.

With these precautions in mind, we designed a yoga program to include no forward bends, no gazing to ceiling in spinal extension, and no extreme twisting. The program had an emphasis on weight-bearing movement between poses; resistance holding poses to build bone and muscle strength; and movements to improve the strength and flexibility of the spine. A body weight metric was taken for each session. This is an overview of Bryan's program based on clinical notes.

- Supine with blanket neck adjustment, a belt was used for extension and flexion of knee to chest and lateral abduction and adduction of legs to the side. This helped support the lower spine and initiated connection with synchronized breathing.
- Other supine spine movements included: elongation, flexion (knees to chest), and extension (modified bridge) all with synchronized breathing.
- From a comfortable seated position or *vajrasana* (hero pose), a centering breath and warm up arm *vinyasa*, moving the spine in five directions taking all safety precautions and with proper breath was sequenced.
- From hands and knee sequences moving the spine in five directions with all safety precautions with proper breath were completed.
- Seated with legs extended forward folds with belt followed by *Janusirsasana* (seated half cobbler) - both poses avoiding a forward bend to keep spine elongated and properly aligned.
- Steps back to standing poses: Lunge, Modified Sun Salutation, and Warrior One using blocks flowing with properly synchronized breath created standing sequences.
- A modified kickstand tree with heel resting to ankle and using the wall for balance, was timed each session and include a breath awareness exercise.
- Legs-up-the-wall at a >60-degree each session.

In each weekly session the yoga intervention was similar, but the intensity was increased. We added movement sequences between standing poses and increased durations in standing/balancing poses. Additionally, an at-home, self-led practice was constructed for mid-week use.

**Session #1** - Bryan was curious and, despite his weakness, eager. The first session included all sequences, except standing poses. Bryan struggled with the breath synchronization and tired easily. Weight 120 lbs.

**Session #2** - Bryan maintained a daily self-directed practice of 30 minutes and extended legs-up-wall. He reported improved appetite. The second session included a simple step back to knee down for modified sun-salutations with spinal safety precautions, high lunge, and a 30 second tree pose. Weight 125 lbs.

**Session #3** - Steroid dosage was reduced by his doctors and it spurred energy resulting in lengthened self-practice. Bryan was eager to learn more demanding standing poses. Weight 130 lbs.

**Session #4** - As steroid dosage continued to be reduced, Bryan gained weight, strength, and confidence. He was curious about breathing practices in standing poses because this seemed to increase his focus to hold poses longer. He was excited to see the increased time he could hold tree pose without significant 'wobble'. His professional experience and knowledge helped him appreciate this pose, not only to meet his personal goals, but as a future appropriate intervention for his patients. Weight 134 lbs.

**Session #5** - Recently, Bryan had a flare up of his GVHD that included muscle fascial pain, skin changes, and GI irritability. A return to a higher dose of steroids was recommended by his doctors. However, Bryan continued self-practice, and he enjoyed modest weight gain and gained confidence in his strength and steadiness. Regardless of the treatment setback and anxiety about a poor prognosis, Bryan was increasingly enthusiastic about yoga as a tool to manage his future. Weight 136 lbs.

**Session #6** - Session six gave witness to a one-minute tree pose which was not only easy for him but accomplished without wobbling. Both results indicated increased muscle strength. He was inspired. Weight 140 lbs.

During the six weeks of yoga therapy sessions, Bryan also started light biking and hiking on his 'good' days. He credited the yoga sessions with enabling this increased activity. He was impressed at how much body awareness yoga afforded him, "*connecting top and bottom*" as he described, "*rather than speed and effort, and yet providing core work.*"

Three months later, Bryan came back for another yoga therapy session. He had continued to gain weight, build muscle mass, remain active with snowboarding, and had continued yoga three to four times a week. Additionally, he had introduced weight training and mountain biking. Corticosteroid dosage continued, so his challenges and risk of osteoporosis remained. In the meantime, he maintains his musculoskeletal fitness and bone strength with daily yoga, snowboarding, and biking. Weight after three months: 155 lbs.

Bryan credits yoga for giving him a way to come back that his other sports would not. He said, *“Yoga became a vital adjunct in my recovery, with multiple sessions per week over several months, and my strength and mobility improved. Yoga had a profound effect on my well-being, ability to concentrate and find confidence to get back snowboarding without fear of fracture. Yoga will be an integral part of my future to mitigate the stiffness that occurs with aging and post-transplant challenges I will face the rest of my life.”*

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