




Clinical Notes

Long-term rehabilitation of a childhood cancer survivor and COVID-19 epidemic

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For childhood cancer survivors, long-term follow up is important as they are at risk of late complications such as fatigue, pain, lower levels of physical activity, and poor social adjustment. The American Cancer Society¹ and American College of Sports Medicine² recommend physical therapy by primary site, disease, and intervention (chemotherapy or radiation therapy), and suggest rehabilitation prescriptions based on the patient's condition. The National Comprehensive Cancer Network (NCCN) published "NCCN Guidelines Insights: Survivorship."³ These guidelines provide screening, evaluation, and treatment recommendations for adult-onset cancer. In children, for example, it was reported that physical training during or after cancer treatment improves lower body muscle strength.⁴ However, there is insufficient evidence for rehabilitation therapy in the long-term follow up of childhood cancer. In Japan, it is difficult to provide cancer rehabilitation other than hospitalization because of the restrictions of the health insurance system.

Long-term rehabilitation follow up was performed for a girl who developed myelodysplastic syndrome with monosomy 7. At 7 years of age the patient underwent total right lung resection due to intractable pneumonia caused by a fungal infection. Four months later, she developed acute myeloid leukemia with myelodysplasia-related changes and was treated with allogeneic bone marrow transplantation (preparative regimen: fludarabine 125 mg/m², melphalan 140 mg/m², anti-human thymocyte immunoglobulin 10 mg/m², and 4 Gy total body irradiation). Acute graft-versus-host disease was grade 4 (skin: grade 2, liver: grade 2, gastrointestinal tract: grade 4). Prednisolone and tacrolimus were administered intravenously as immunosuppressive therapy for about 2 months after bone marrow transplantation. She was then treated with oral tacrolimus for 3.5 years. She had pneumococcal meningitis at 9 years of age, probably caused by immunosuppressive therapy.

In the acute phase of leukemia treatment, which included bone-marrow transplantation and lung resection, respiratory

physiotherapy and rehabilitation therapy for disuse syndrome due to cancer treatment were provided. After discharge from the bone marrow transplantation, or finishing hematological oncologic treatment, the patient had decreased physical strength and easy fatigability. Outpatient rehabilitation was continued to improve physical function and endurance. She visited our rehabilitation for self-training one to three times a month, and was supervised and trained by a physical therapist once every 1–3 months. Rehabilitation sessions included endurance training, using apparatus such as an ergometer. The patient was transferred to a special needs school after hospital discharge due to easy fatigability. In the first year of junior high school (age 13), she was hospitalized for 1 month for intensive physical rehabilitation. Her 6 min walking distance and grip strength improved remarkably during and after her 1 month hospitalization. However, in 2020, due to the coronavirus (COVID-19) epidemic, she lost the opportunity to go out, including coming to our center for about 6 months. Her physical function subsequently declined. Resumption of hospital visits and rehabilitation exercise while the epidemic was winding down resulted in some improvement, but the effect was limited (Fig. 1). At 18 years of age, her physical functions were as follows: performance status 1, body mass index 19.5, left ventricular ejection fraction 54%, vital capacity 45.9%, and forced expiratory volume in 1 s 68.6%. Her physical limitations may be due to the effects of respiratory dysfunction as well as easy fatigue after cancer treatment.

Exercise intolerance is prevalent among childhood cancer survivors, especially among survivors exposed to anthracyclines and/or chest-directed radiation.⁵ Rehabilitation therapy for cancer patients is effective not only for patients undergoing treatment, such as chemotherapy and radiotherapy, but also for survivors after cancer treatment.^{1,2} In this case, we believe that both intensive rehabilitation intervention and regular rehabilitation therapy were effective for improving physical function and endurance. In fact, her 6-min walking distance, grip strength, and easy fatigability were improved by intensive rehabilitation intervention and worsened during the temporary suspension of regular intervention due to the COVID-19 epidemic. The rehabilitation approach and her usual activity intensity in usual life were essential for the continuous

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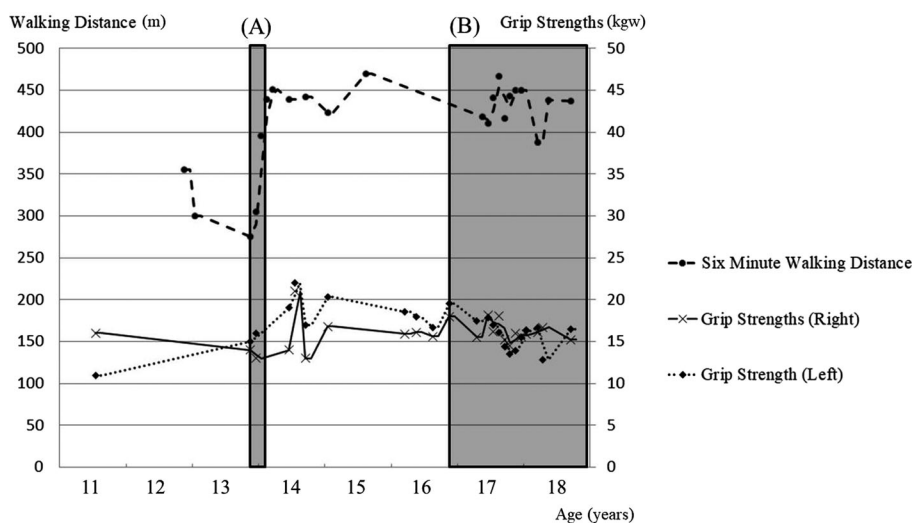


Fig. 1 The results of 6 min walking distance and grip strengths. (a) The duration for which the patient was hospitalized for 1 month for the purpose of intensive physical rehabilitation approach. Her 6 min walking distance and grip strengths improved remarkably. (b) The duration for which the patient's hospital visits for rehabilitation became irregular due to the COVID-19 epidemic. She stopped coming to our rehabilitation center for about 6 months. After this, she partially resumed her hospital visits while the epidemic was winding down. Her physical function had gradually declined, and resumption of hospital visits and rehabilitation exercises resulted in some improvement. (◆), grip strengths (left); (×), grip strengths (right); (●), six minute walking distance.

maintenance and improvement of physical function and quality of life. Despite the limitations imposed by the health insurance system, the provision of rehabilitation therapy, including tele-rehabilitation and collaborative support with school education, should be considered for cancer survivors who suffer from a decrease in physical function and activity.

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Disclosure

The authors declare no conflict of interest.

Author contributions

H.M. wrote the manuscript. K.K., A.S., E.I. and Y.H. reviewed the manuscript and gave advice from the perspective of their specialties. All authors read and approved the final manuscript.

Ethical approval and informed consent

This study was approved by the Ethics Committee of Shizuoka Children's Hospital (approval number R2-93) and we obtained informed consent for this case presentation from the patient and her guardian.

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