

Physical Therapy as Adjuvant Therapy for Patients Undergoing Allogeneic Haematopoietic Stem Cell Transplantation

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Allogeneic hematopoietic stem cell transplantation (allo-HSCT) has been increasingly used in treating hematopoietic diseases worldwide [1,2]. This treatment has disease-specific 5-year survival rates ranging from 5%–80% [3]. Allo-HSCT is associated with numerous treatment-related somatic, psychological, and psychosocial side effects [4]. Patients experience considerable physical and functional deterioration and diminished psychological well-being before, during, and after allo-HSCT [5,6]. Our previous study showed reduced skeletal muscle strength and exercise tolerance in patients prior to allo-HSCT compared with population norms (respectively almost 20%) [7]. Furthermore, we also showed that patients receiving allo-HSCT experienced significant (almost 20%) decrease in grip strength, knee-extensor strength, and 6-min walking distance following transplantation [8]. Therefore, in patients receiving allo-HSCT, physical exercise has been proposed as a means of recovering from the loss of functional capacity and muscle weakness that can occur with prolonged lack of physical activity after transplantation [9].

A systematic review was conducted by van Haren et al. [10] on physical exercise intervention among patients undergoing allo-HSCT. Meta-analyses showed that exercise during hospitalization led to a higher quality of life (QOL) and less fatigue on discharge in patients receiving allo-HSCT. Jarden et al. [11], Wiskemann et al. [12], and Baumann et al. [13] reported randomized controlled trials (RCTs) on the effect of physical exercise on QOL in patients undergoing allo-HSCT, which revealed that the exercise group had a significantly higher QOL than the control group. Jarden et al. [11], and Wiskemann et al. [12] showed that fatigue levels were significantly lower in the exercise group than in the control group. RCTs showed that exercise improved physical functions such as muscle strength and exercise tolerance in patients undergoing allo-HSCT [11-14].

Unlike physical exercise, physical therapy can be performed via a one-on-one approach (physical therapist to the patient). Moreover, the physical therapist can perform exercises involved in risk management, wherein the patient's condition is evaluated daily. The physical therapy schedule at our hospital is presented in detail in Figure 1. The equipment for physical therapy was kept in a physical therapy room or the patient's room, where the patients exercised between 20 and 40 min per day, and for 5 days per week [15]. The physical therapy programme consisted of stretching exercises, resistance exercises, and endurance exercises. Stretching was a primarily passive exercise that was performed with the assistance of a physical therapist; the stretching exercise primarily involved the lower limb and trunk muscles (10 min). Resistance exercise was performed under the supervision of physical therapists (10 min), and involved the lower limb muscles. The exercise intensity was chosen by determining the effort rating during 10 lifts, using the rating of perceived exertion (RPE) on the modified Borg scale [16]. The weight was controlled to a rating of 4 ('somewhat strong'), which is equivalent to approximately 60% of the maximum lifting capacity. If the Borg scale score was <4, a heavier weight was used, until the appropriate RPE was reached. The movement during exercise was maintained at a slow speed (4–6 s to lift and lower the weight) through the entire

pain-free range of motion. Endurance exercise was performed using a stationary bicycle (15–20 min). The endurance exercise intensity was set to 40%, as calculated using Karvonen's equation [17]: $[(220 - \text{age}) - (\text{resting heart rate})] \times (40\%) + (\text{resting HR})$. Daily core exercises for abdominal and back muscles were added in 1–2 sets of 10 repetitions. As appropriate, physical therapy also included the activities of daily living (ADL) training, such as climbing stairs and rising from the floor, and balance training using a physioball. Physical therapy was performed in the patient's single-bed room during the cytopenia phase. Physical therapy, except for endurance exercise, was performed as described during the non-cytopenic period. Resistance training was performed by manipulating the resistance offered by the physical therapist instead of the cuff weights. Physical therapy also included balance training, such as one-leg standing, standing on tiptoes, and lunges, as appropriate. Our previous study showed physical therapy is beneficial, safe, and feasible even in patients who have cytopenia during allo-HSCT [15]. Patients who participated in more frequent physical therapy experienced fewer declines in physiological function and QOL than those who did not. This study showed that physical therapy interventions were well-tolerated and safe in patients undergoing allo-HSCT. Starting therapy before or just after transplantation seems to be of maximum benefit. However, physical therapy was discontinued if the patients had severe graft versus host disease, pain, nausea, dizziness, or fever (body temperature > 38°C). Physical therapists can vary the exercise regimen in terms of frequency, intensity, and duration to match the patient's condition and complaints. A previous study reported that HSCT patients often experience depression after HSCT as patients remain in a single-bed isolation room for several weeks. The patients may experience an improvement in the mood as well as physical function by performing physical therapy, such as one-on-one therapy (physical therapist to the patient). Thus, we see that physical therapy is a beneficial adjuvant in patients receiving allo-HSCT.

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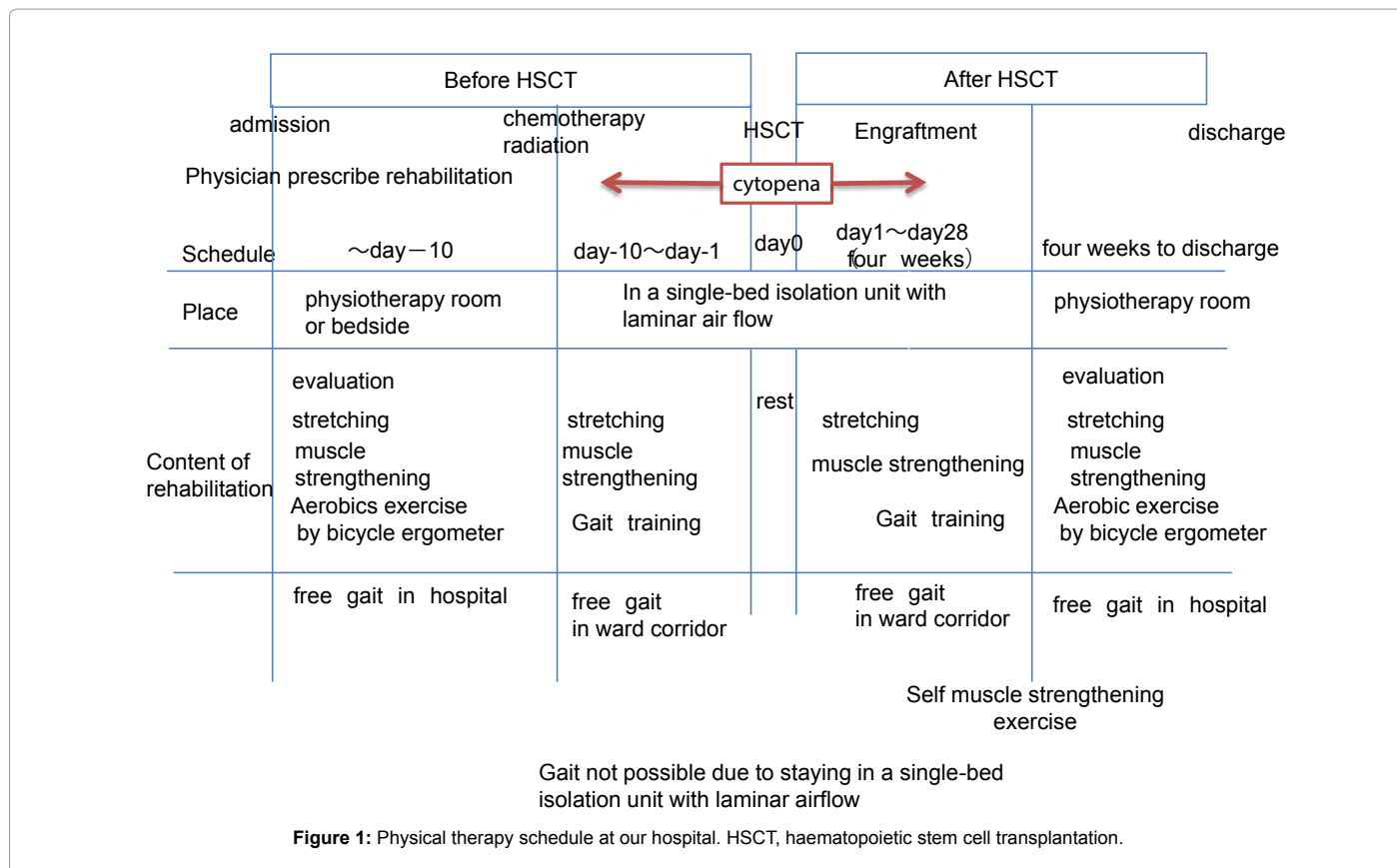
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