



## Original Research

# The Power of Reiki: Its Effects on Pain and Biochemical Parameters in Patients Undergoing Bone Marrow Transplantation: A Randomized Prospective Controlled Study<sup>☆</sup>



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## ABSTRACT

**Purpose:** This study aimed to determine the effects of Reiki on pain and biochemical parameters in patients undergoing bone marrow transplantation.

**Design:** This research was a single-blind, repeated measures, randomized prospective controlled study.

**Method:** This study was conducted between August 2022 and April 2023 with patients who underwent autologous in the bone marrow transplantation (BMT) unit. In the Reiki group ( $n = 21$ ), Reiki therapy was applied directly to the energy centers for 30 min on the 0th and 1st day of BMT, and from a distance for 30 min on the 2nd day. No intervention was performed on the control group ( $n = 21$ ). Data were collected using the Personal Information Form, Visual Analog Scale (VAS), and biochemical parameters. Pain and biochemical parameters were evaluated on days 0, 1, 2, and 10 before the Reiki application.

**Result:** There were no statistically significant differences in pain scores between the groups before the intervention ( $p > .005$ ). The Reiki group showed a significant improvement in the mean VAS score compared with the control group on days 1 and 2 ( $p = .002$ ;  $p < .001$ , respectively). The measurement of procalcitonin showed a decrease in the Reiki group and an increase in the control group ( $p = .026$ ,  $p = .001$ ,  $p < .001$ , respectively). Although the Reiki group had better absolute neutrophil, thrombocyte, and C-reactive protein values than the control group, no significant difference was observed between the groups ( $p > .05$ ).

**Conclusion:** Reiki is effective for pain control and enhancing the immune system response.

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Cancer remains a global and chronic health problem. According to the National Cancer Institute (NCI) report, it is estimated that there will be 1,958,310 new cancer cases and 609,820 cancer-related deaths in the United States in 2023 (Siegel et al., 2023). In Turkey, cancer ranks second among the causes of death after cardiovascular diseases (Hacıkamiloğlu et al., 2017). With the increasing incidence of cancer, there have been significant advancements in cancer treatment in recent years (Siegel et al., 2023; Simpson & Dazzi, 2019). Along with conventional treatments such as chemotherapy, surgery, and radiotherapy, bone marrow transplantation (BMT) is an important method used to achieve remis-

sion in cancer treatment (Baydoun & Barton, 2018; Simpson & Dazzi, 2019). BMT offers promising prospects for remission and complete recovery. BMT involves transplanting stem cells to produce cells. However, the transplantation process and its aftermath significantly affect patients. After transplantation, patients experience not only psychosocial issues but also serious physical problems, such as pain, immunosuppression, and infection (Abo et al., 2021; Kenyon & Babic, 2023; Zucchetti et al., 2019).

Pain is also a specific symptom that requires careful evaluation and intervention in patients undergoing BMT (Zucchetti et al., 2019). Approximately 30%–50% of BMT patients experience pain (Ma et al., 2018). Personalized pain management is important for patients because pain includes clinical, cognitive, and psychological experiences (Ma et al., 2018; Okolo & Gowin, 2019; Zucchetti et al., 2019). There are many pharmacological methods for preventing and reducing pain (Okolo & Gowin, 2019). However, considering

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the side effects of aggressive treatment methods in patients with cancer, the use of safe and side-effect-free methods for pain management is prominent. Complementary and integrative therapies are often preferred for pain management and immune system strengthening in patients with cancer (Baydoun & Barton, 2018; Ludwick et al., 2020; Okolo & Gowin, 2019; Yun et al., 2017). Because after the BMT the inactive immune system causes infection. Infection is associated with significant morbidity and mortality; thus, prevention is critical to improve outcomes. Neutrophil and thrombocyte values are important systemic inflammatory response parameters for predicting clinical outcomes and prognosis after BMT (Ma et al., 2018).

Reiki is a complementary support method for managing pain and enhancing the immune system after BMT (Okolo & Gowin, 2019; Zucchetti et al., 2019). It is an energy and touch healing therapy that aims to balance the energy flow in individuals by sending energy from the universe through the hands (Alarcão & Fonseca, 2016; Demir Doğan, 2018; Dyer et al., 2019; Okolo & Gowin, 2019). It does not require any invasive procedures, and it is considered safe. Reiki aims to harmonize the physical, mental, and spiritual aspects of a person through this energy flow (Alarcão & Fonseca, 2016; Demir Doğan, 2018; Dyer et al., 2019). This harmonious effect on the body's internal and external environment can stimulate the mind and activate the hypothalamus. The hypothalamus can influence the psycho-neuro-immunological system and increase immune cell counts (Wind et al., 2001). The physiological effect of Reiki on pain can be explained by its activation of the hypothalamus. By stimulating the skin and sensory fibers and activating the hypothalamus, it suppresses pain signals and induces the secretion of endorphins, providing relief (Utli et al., 2023). Therefore, Reiki is preferred as an easy, noninvasive, safe, and cost-effective method for reducing pain in cancer patients (Alarcão & Fonseca, 2016; Demir Doğan, 2018; Dyer et al., 2019; Okolo & Gowin, 2019; Utli et al., 2023; Zucchetti et al., 2019).

Although there are studies on complementary and integrative therapies for managing symptoms after BMT (Baydoun & Barton, 2018; Okolo & Gowin, 2019; Smith et al., 2003), the number of studies on Reiki is limited (Alarcão & Fonseca, 2016; Utli et al., 2023; Zucchetti et al., 2019). Moreover, there are insufficient studies in the literature that investigate the effect of Reiki on engraftment in BMT patients (Kenyon & Babic, 2023). Therefore, this study was conducted to determine the effect of Reiki on pain and biochemical parameters in patients undergoing BMT.

## Materials and Methods

### Research Design

This study used a pretest-posttest, prospective, single-blind and randomized controlled research design. Patients were randomized using the online application Research Randomizer by a single therapist at a single institution, following a parallel design with a 1:1 allocation ratio to different groups (Fig. 1) (Moher et al., 2010). There were two treatment arms in the study: Reiki treatment and control group with no treatment. Patients were blinded to the group assignments.

### Participants and Settings

The study was conducted at a training and research hospital in the Medical Oncology Department's BMT unit, after obtaining ethical committee and institutional approval, between August 2022 and April 2023. The sample size was calculated using a power

of 0.80, an alpha level of 0.05, and a Cohen's *d* effect size of 0.75, based on the scale used in this study and previous research (Alarcão & Fonseca, 2016; Zucchetti et al., 2019), resulting in a sample size of 42. The G Power 3.1.9.4 program was used for the sample size calculation. Patients who met the inclusion criteria were identified in collaboration with the oncology specialist. The inclusion criteria were as follows: patients who underwent autologous BMT, were on the zeroth day of BMT, were 18 years of age or older, had no communication problems, agreed to participate in the Reiki application, experienced pain, were considered suitable for Reiki by the oncology specialist, could respond to the data collection tool to be used in the study, and had not used complementary practices in the past 6 months. Patients who were not on the zeroth day of BMT, were Reiki practitioners or trainers, had received energy therapies such as Reiki, had been diagnosed with another disease during the allogeneic bone marrow transplantation (ABMT) research process, had experienced exitus after transplantation, did not report pain, or declined participation in the study were excluded from the study.

### Data Collection

Patients who met the inclusion criteria were informed about the study by the researchers and were included in the study upon their consent to participate. Data from the consenting patients were obtained using the Personal Information Form, Visual Analog Scale (VAS), and Biochemical Parameters.

**Personal Information Form:** The form was developed by the researchers based on a literature review (Abo et al., 2021; Alarcão & Fonseca, 2016; Ma et al., 2018; Utli et al., 2023; Zucchetti et al., 2019). It includes five questions related to the patient's demographic characteristics of age (years), gender, employment status, education level, and monthly income level. In addition, there are five questions regarding the type and stage of cancer, time since diagnosis (months), existing comorbidities, and other treatments received excluding BMT.

**Visual Analog Scale (VAS):** It is a reliable and easily applicable scale used to measure the severity of pain in patients, and is accepted in the literature. The scale, which was used to digitize the values that could not be measured numerically, was used to evaluate the pain intensity of the patients. A minimum of 0 and maximum of 10 points can be obtained from the scale (0 = no pain and 10 = worst imaginable pain). High scores indicate increased pain intensity. The patient marks the pain he feels on this 10-cm line. The distance between the marked point and point 0 is measured in cm. This point numerically indicates the severity of the patient's pain (Hawker et al., 2011). In addition, the pain levels of the patients were evaluated using the Visual Analog Scale (VAS) along with the National Cancer Institute Common Terminology Criteria for Adverse Events-CTCAE, 2017 (Cancer Therapy Evaluation Program, 2017). The patients were asked about their pain every morning on days 0, 1, 2, and 10 before blood samples were collected and Reiki was applied. Pain assessment in the clinic was routinely performed every morning between 07.30 a.m., and 08.00 a.m., before treatment and medical procedures.

**Biochemical Parameters:** After BMT blood levels such as neutrophil, thrombocyte, hemoglobin, and hematocrit may decrease because of suppressed bone marrow. It takes time for the bone marrow to function normally after transplantation ("Qual. Manag. Accred. Hematop. Stem Cell Transplant. Cell. Ther.," 2021; Kenyon & Babic, 2023). Therefore, follow up neutrophil and thrombocyte counts are extremely important. According to the JACIE Guide (2021), the absolute neutrophil count (ANC) in the blood should be  $\geq 0.5 \times 10^9/L$ , and the thrombocyte count should be  $> 20 \times 10^9/L$  to indicate successful engraftment. Routine blood tests,

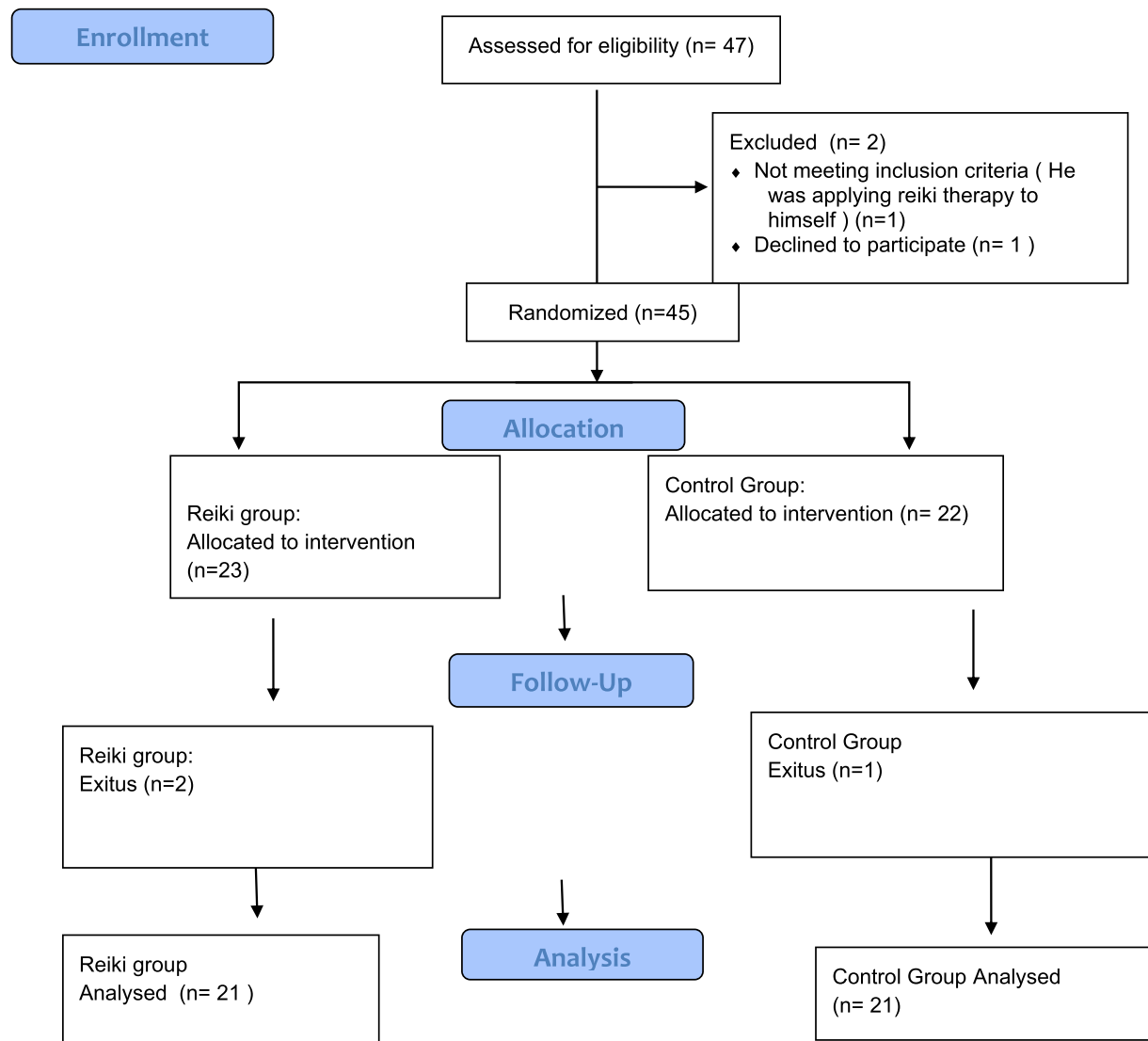


Figure 1. The CONSORT chart of the study.

biochemistry, and C-reactive protein (CRP) monitoring are recommended within the first 100 days (Aljurf et al., 2021). Hemoglobin, hematocrit, CRP, and procalcitonin (PCT) levels were routinely monitored in the clinic (Kenyon & Babic, 2023). Although CRP is not specifically used to diagnosing engraftment syndrome, a sudden and significant increase in CRP levels may support the diagnosis. In the clinic, blood samples were collected from fasting patients every morning by clinical nurses. Routine blood were continued for the patients.

#### Intervention Protocol (Reiki Group)

Patients assigned to the Reiki group were administered the Personal Information Form and VAS during the initial interview. Biochemical parameters (absolute neutrophil, thrombocyte, hemoglobin, hematocrit, PCT, and CRP obtained in the morning were recorded). Reiki sessions were conducted by the same researcher in the BMT unit to ensure the patients' protection from infection, and to avoid influencing the biochemical parameters, blood samples were collected every morning before the Reiki sessions.

Reiki application consists of three levels: First degree, Second degree, and Third degree (Master and Teacher). At the first level, practitioners balance their own energies. At the second level, practitioners can send Reiki energy to others by using Reiki symbols. At the third level, the person can train new practitioners (Demir Doğan, 2018; Utli et al., 2023; Wind et al., 2001). In this study, on the zeroth and first day of BMT, Reiki II stage was applied for 30 minutes to the energy centers on a one-to-one basis, under the guidance of a researcher with Usui Reiki Master & Teacher degree and administered by another researcher who had received training in Reiki II stage, following the Reiki application protocol (supplementary material). A Reiki intervention protocol was prepared following the views of an expert based on previous studies in the literature (Alarcão & Fonseca, 2016; Demir Doğan, 2018; Utli et al., 2023; Wind et al., 2001; Zucchetti et al., 2019).

Before the application, the practitioner washed their hands. Patients were placed in a comfortable lying or reclining position. Reiki practitioners generally keep their hands 10–15 centimeters above the body surface, and also by touching energy points with permission (Demir Doğan, 2018; Utli et al., 2023; Wind et al., 2001). After the procedure, patients were allowed to rest, and if

**Table 1**  
Descriptive Features of the Participants in the Reiki and Control Groups.

Socio-Demographic Characteristics of Patient	Reiki (n = 21) n (%)	Control (n = 21) n (%)	p Value
<b>Age</b> (years) (Mean ± SD)	34.38 ± 11.15	37.19 ± 11.56	.427*
<b>Sex</b>			
Woman	5 (23.8)	7 (33.3)	.733**
Man	16 (76.2)	14 (66.7)	
<b>Current employed status</b>			
Employed	2 (9.5)	5 (23.8)	.410
Unemployed	19 (90.5)	16 (76.2)	
<b>Education</b>			
Primary education	5 (23.8)	5 (23.8)	.776
High school	8 (38.1)	10 (47.6)	
University	8 (38.1)	6 (28.6)	
<b>Income status</b>			
Less income	7 (33.3)	13 (61.9)	.122
Enough income	14 (66.7)	8 (38.1)	
<b>Type of cancer</b>			
Testis	10 (47.6)	11 (52.4)	.782
Over	7 (33.3)	5 (23.8)	
Ewing sarcoma	4 (19.1)	5 (23.8)	
<b>Diagnosis time (month)</b>			
6 ≤ <12 month	10 (47.6)	14 (66.7)	.350
24 month >	11 (52.4)	7 (33.3)	
<b>Treatment history</b>			
Chemotherapy	6 (28.6)	6 (28.6)	N/A
Surgery + chemotherapy	15 (71.4)	15 (71.4)	

\* Mann-Whitney U test,

\*\*  $\chi^2$  test N/A = Non available.

there were no contraindications, they were given a glass of water. On the day 0, 1, and 2 posts of BMT, VAS, and biochemical values were recorded. On the third day, the same researcher performed a 30-min distant Reiki application was performed by the same researcher. One week after the distant Reiki application on the third day (tenth day of BMT), VAS and biochemical values were re-evaluated.

#### Control Group

Patients in the control group were administered the Personal Information Form and the VAS during the initial interview. The morning biochemical parameters (absolute neutrophil, thrombocyte, hemoglobin, hematocrit, PCT, and CRP were recorded.) No Reiki application was performed in this group. VAS and biochemical values were recorded on the 0th, 1st, 2nd, and 10th days of BMT.

#### Statistical Analysis

All statistical analyses were performed using SPSS® software version 26.0 (IBM Corp., Armonk, NY, USA). The descriptive statistics summarize the data by using mean ± SD, percentage, median, and interquartile ranges. The Mann-Whitney U test was used to compare two independent variables that were non-normally distributed. The chi-square test was used to compare categorical data. The changes in biochemical values and VAS were calculated using the linear mixed model. The use of post hoc test correction adjusted the significance level to  $p < .017$ . A  $p$ -value of less than .05 in the 95% confidence interval was considered to indicate statistically significant.

#### Ethical Considerations

The study was carried out in accordance with the Declaration of Helsinki (2013) and was approved by the Ethics Committee of Clinical Research of the University of Health Sciences Gulhane

Training and Research Hospital (28.07.2022-E.14). The formal permissions were also obtained from the hospital where carried out study and health province department. (Clinical Trial Number is: NCT05694910). We confirm that all patients consented to participation based on the concept of written informed consent. After collecting the final test data, Reiki was applied to all patients in the control group to fulfill the principle of "receiving adequate and appropriate care."

## Results

#### Demographics

The two groups exhibited homogenous sociodemographic characteristics ( $p > .05$ ) (Table 1).

#### VAS

The pain scores of the patients are presented in Table 2 and Fig. 2. There were no statistically significant differences in pain scores between the groups before the intervention ( $p > .05$ ). However, significant differences were observed between the Reiki and control group on the first and second days ( $p = .002$  and  $p < .001$ , respectively).

In the Reiki group, there were statistically significant differences in pain scores between the 0th and 10th days ( $p < .001$ ) and between the 1st and 10th days ( $p < .001$ ). Similarly, in the control group, there were statistically significant differences in pain scores between the 0th and 1st days ( $p = .001$ ), between the 1st and 10th days ( $p < .001$ ), and between the 2nd and 10th days ( $p < .001$ ) (Table 2).

#### Biochemical Parameters

The biochemical parameters of the patients are presented in Table 3. There were no significant differences in absolute neutrophil, thrombocyte, hemoglobin, hematocrit, PCT and CRP values

**Table 2**  
Comparison of Changes in VAS Within and Between the Reiki and Control Group.

VAS	0.day Median (IQR)	1.day Median (IQR)	2.day Median (IQR)	10.day Median (IQR)	p Value
<b>Reiki</b>	4 (2.5-6)	5 (3-6)	4 (3-5.25)	2 (1-3.5)	<b>.000**</b>
<b>Control</b>	5.5 (4-6)	6.5 (5-7.5)	7 (5.5-8)	3 (2-4)	<b>.000**</b>
<b>p value</b>	.203	<b>.002*</b>	<b>.000*</b>	.051	

\* Mann–Whitney U test.

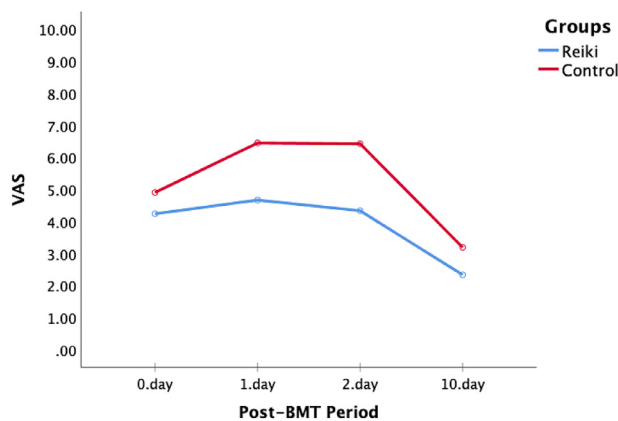
\*\* Repeated Measure ANOVA IQR = Inter quartile range.

**Table 3**  
Comparison of Changes in Biochemistry Blood Values Outcomes Within and Between the Reiki and Control Group.

Biochemistry Blood Values		0.day Median (IQR)	1.day Median (IQR)	2.day Median (IQR)	10.day Median (IQR)	p Value
<b>Absolute neutrophil</b> (x10 <sup>3</sup> /μL)	<b>Reiki</b>	1.6 (0.5-2.15)	1.30 (0.26-1.65)	0.45 (0.13-0.89)	3.20 (1.6-5.30)	<b>.000**</b>
	<b>Control</b>	1.9 (0.51-3.90)	0.93 (0.11-1.70)	0.30 (0.025-0.77)	2.70 (2.35-3.47)	<b>.000**</b>
	<b>p</b>	0.120*	0.641	0.398	0.623	
<b>Thrombocytes</b> (x10 <sup>3</sup> /μL)	<b>Reiki</b>	114 (70 -152)	90 (62.5-103.)	66 (41-75)	31 (25-75)	<b>.000**</b>
	<b>Control</b>	111 (69-142)	84 (72-94)	48 (29-64)	18.8 (17-53)	<b>.003**</b>
	<b>p</b>	0.246	0.529	0.082	0.071	
<b>Hemoglobin</b> (x10 <sup>3</sup> /μL)	<b>Reiki</b>	10.0 (8.8-10.95)	9.3 (8.05-10.5)	8.4 (6.9-9.8)	10.1(9.3-10.8)	.006
	<b>Control</b>	10.2 (9.7-11.6)	9.2 (7.70-10.2)	8.1 (6.64-8.85)	10.2 (9.5-11.8)	.007
	<b>p</b>	0.147	0.870	0.308	0.364	
<b>Hematocrit (%)</b>	<b>Reiki</b>	29.3 (26.85-34.25)	26.4 (24.7-30.9)	25.8 (24.15-28.5)	30.4 (26.25-32.5)	.012
	<b>Control</b>	29.7 (28.45-34.20)	27.2 (25.6-30.3)	24.83 (21.5-26.4)	30.7 (27.00-36.7)	<b>.001**</b>
	<b>p</b>	0.450	0.705	0.110	0.112	
<b>PCT (%)</b>	<b>Reiki</b>	4.20 (0.33-39.00)	5.32 (1.88-33.5)	4.26 (2.58-6.46)	2.60 (0.49-4.15)	.055
	<b>Control</b>	9.00 (0.93-29.00)	15.82 (5.6-35.81)	15.59 (7.93-29)	17.00 (1.61-23.00)	.461
	<b>p</b>	0.920	0.026	<b>.0001*</b>	<b>.0000*</b>	
<b>CRP (mg/dl)</b>	<b>Reiki</b>	3.7 (2.83-7.85)	5 (3.53-8.47)	9.7 (5.25-16.5)	78 (26-171)	<b>.001**</b>
	<b>Control</b>	3.5 (2.30-6.64)	6.72 (3.20-10.51)	14 (8.21-24.4)	109 (66-238)	<b>.001**</b>
	<b>p</b>	0.792	0.606	0.059	0.124	

\* Mann–Whitney U test.

\*\* Repeated Measure ANOVA IQR = Inter quartile range.



**Figure 2.** Vas score changes after BMT (bone marrow transplantation) in reiki and control groups.

between the groups before the intervention ( $p > .05$ ). No statistically significant differences were observed in absolute neutrophil count, hemoglobin, and hematocrit values between the groups on the first, second, and tenth days ( $p > .05$ ). However, there were significant differences in PCT values between the 0th and 2nd days, 2nd and 10th days in both groups ( $p < .001$ ,  $p = .001$ ) (Table 3).

## Discussion

In our study, a statistically significant difference between biochemical values was observed only for procalcitonin. Procalcitonin is a biomarker that facilitates early identification of infection in immunocompromised patients with cancer. Serum PCT levels tend

to rise faster than other markers of infection. Thus, it creates the potential for early intervention and improving clinical outcomes (Lee et al., 2024). It is important to protect patients from infection and ensure immunity, starting from the day zero after transplantation (Kenyon & Babic, 2023; Lee et al., 2024; Aljurf et al., 2021). In our study, the decrease in PCT levels in the Reiki group starting from the 1st day, especially on the 2nd and 10th days, was an important finding showing its contribution to immunity. In fact, this finding is not surprising because Reiki has a positive effect on the body's immune systems (Dyer et al., 2019). In the human body, there are three interconnected macromolecular energy-information transfer systems, each produced by a specific semiconductor tissue types and each serving specific functions. The connective tissue known as the meridian system functions in immune regulation through the transmission of energy information related to the immune response (Brown, 2009). Reiki, by stimulating this connective tissue system, is believed to directly affect the bone marrow energy information system and also influence the vagus nerve and spinal cord (Brown, 2009; Wind et al., 2001). Reiki, being applied as a single session, was reported to provide benefits at the moment of application and influence the immune system (Dyer et al., 2019). However, studies evaluating the effects of Reiki on the immune system and examining biochemical markers are limited (Brewitt et al., 1997; Rubik et al., 2006; Wetzel, 1989; Wind et al., 2001). In this context, our study may contribute to the literature by examining routine biochemical values in patients undergoing BMT. In a study, Reiki was applied to patients with chronic illness, and changes in the neuroendocrine-immune system in the meridians were identified using an electrodermal test (Brewitt et al., 1997). In another study involving 23 healthy individuals, Reiki increased salivary IgA levels immediately after the session (Wind et al., 2001). An in vitro study evaluating the effect of



Reiki on bacterial cultures revealed that Reiki practitioners placed their hands approximately 10-cm away from bacterial culture lids, connected with the bacterial cultures for 15 min, and practiced Reiki. It was found that Reiki improved the growth of heat-shocked bacterial cultures in the context of healing (Rubik et al., 2006). These studies showing the effect of Reiki on the immune system, which are as limited as we can find, are parallel to our research findings.

In our study, we observed higher absolute neutrophil and platelet count were higher, and the CRP levels was lower, although the difference was not statistically significant. In addition, there was no significant difference in hemoglobin and hematocrit values between the groups. A study in which Reiki was applied and biochemistry was examined was different from our research results. In a study with 48 healthy individuals who received Reiki training, it was found that hemoglobin and hematocrit values increased significantly compared with the control group (Wetzel, 1989). The reason why our results differed from this finding might be related to the exclusion of immunosuppressed individuals from the study.

Another challenging complication that needs to be managed in BMT is pain. It is one of the most common symptoms in patients with cancer and can lead to psychological, mental, and physiological problems (Demir Doğan, 2018; Yun et al., 2017; Zucchetti et al., 2019). In our study, the pain score on the 1st day of the Reiki group was 5, and on the 2nd day was 4. This score represents the patient's moderate pain according to the World Health Organization (WHO) pain ladder (Anekar et al., 2023). The control group scored 6.5 points on the first day, which increased to 7 points the following day. This score indicates serious pain, and is not easily uncontrolled (Anekar et al., 2023). Although pain levels decreased in the Reiki group, they increased in the control group. These changes are clinically important. Reduced pain levels provide physical and physiological relief to the patient and reduce complications that may occur due to pain (Avci and Gün, 2023; Bricco et al., 2012; Utli et al., 2023). In addition, according to the WHO pain ladder, it requires less pharmacological treatment (Anekar et al., 2023). On the contrary, increased pain levels and severe pain scores results in mental and physical issues, impairments to mental processes including thought and speech, and a decline in the patients' social networks (Avci and Gün, 2023; Bricco et al., 2012; Utli et al., 2023). Additionally, it requires more pharmacological treatment, such as administration of strong opioids (Anekar et al., 2023).

Worldwide, cancer patients use integrative therapies like Reiki to minimize pain during medical treatments (Okolo & Gowin, 2019; Yun et al., 2017). Meta-analyses and reviews have shown that Reiki significantly reduces pain (Avci and Gün, 2023; Demir Doğan, 2018; Thrane & Cohen, 2014). Other studies have also demonstrated the effectiveness of Reiki in reducing pain in cancer patients (Billot et al., 2019; Biracco et al., 2012; Demir Doğan, 2018; Dyer et al., 2019; Olson et al., 2003; Utli et al., 2023). Consistent with our results, Utli et al. (2023) found that Reiki intervention reduced pain in patients with stage III and IV cancer. Zucchetti et al. (2019) applied 30-min Reiki sessions to 9 pediatric patients who underwent BMT, totaling 88 Reiki sessions. They observed that pain levels decreased in the short- and medium-term follow-up periods and remained stable. Olson et al. (2003) kept factors such as cancer diagnosis, source of pain, and previous opioid exposure constant in both the Reiki and control groups and demonstrated a reduction in pain scores in the Reiki group compared to the control group. While there are existing studies evaluating the effect of pain on patients with cancer and other groups (Billot et al., 2019; Demir Doğan, 2018; Dyer et al., 2019), the fact that only a few studies have been

conducted on patients undergoing bone marrow transplantation (Demir Doğan, 2018; Smith et al., 2003) highlights the significance of our study.

## Conclusion

We determined that the PCT of the Reiki-treated group significantly decreased. The pain scores of the group receiving Reiki decreased compared with those of the control group on the 1st and 2nd days. Although not statistically significant, we observed that the Reiki group had higher absolute neutrophil count, thrombocytes, and CRP values compared with the control group, while hematocrit and hemoglobin values were similar between the groups. In addition, this study has some strengths. First, this was an interventional study with a specific group undergoing BMT. Second, tracking various biochemical values. Third, only one practitioner delivered the Reiki intervention to all patients. In addition, one-to-one application to each patient and time separation, follow-up of these patients is an important aspect of the study.

## Limitations

This study has some limitations. One limitation of this study was that although the clinic's routine analgesic procedure was applied to all patients to ensure pain control, factors like psychological and social aspects that could affect the patients' pain levels were not fully controlled. The second limitation of this study was that it included patients with testicular, ovarian, and Ewing's tumors, and it is recommended to replicate the study with other types of cancer. Third limitation of this study is that participants were not double blinded on inclusion. Another limitation of the study is that the data regarding the use of nonpharmacologic pain and symptom management practices were not based on direct observation of nurses' actual practices. Instead, information on the use of these practices relies on self-reporting by nurses. Therefore, the interpretation and generalization of these results should be made considering this limitation. Additionally, the study was conducted in a single hospital and with a small group. It may be recommended to do perform it in many hospitals with more patients.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## CRediT authorship contribution statement

**Nilay Bektas Akpinar:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Nursemin Unal:** Conceptualization, Methodology, Writing – review & editing. **Gamze Alıncak:** Conceptualization, Methodology, Validation. **Canan Pörücü:** Data curation, Validation, Visualization. **Sabire Yurtsever:** Conceptualization, Project administration, Supervision, Writing – review & editing. **Nuri Karadurmus:** Conceptualization, Supervision.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.pmn.2024.08.008.

## References

- Alarcão, Z., & Fonseca, J. R. S. (2016). The effect of Reiki therapy on quality of life of patients with blood cancer: Results from a randomized controlled trial. *European Journal of Integrative Medicine*, 8(3), 239–249. <https://doi.org/10.1016/j.eujim.2015.12.003>.
- Aljurf, M., Snowden, J. A., Hayden, P., Orchard, K. H., & McGrath, E. (Eds.). (2021). *Quality Management and Accreditation in Hematopoietic Stem Cell Transplantation and Cellular Therapy*. Springer. <https://doi.org/10.1007/978-3-030-64492-5>.
- Anekar, A. A., Hendrix, J. M., & Cascella, M. (2023). *WHO analgesic ladder*. Treasure Island (FL): StatPearls Publishing.
- Abo, S., Denehy, L., Ritchie, D., Lin, K. Y., Edbrooke, L., McDonald, C., & Granger, C. L. (2021). People with hematological malignancies treated with bone marrow transplantation have improved function, quality of life, and fatigue following exercise intervention: A systematic review and meta-analysis. *Physical Therapy*, 101(8), pzab130. <https://doi.org/10.1093/ptj/pzab130>.
- Avci, A., & Gün, M. (2023). The effect of Reiki on pain applied to patients with cancer. *Holistic Nursing Practice*, 37(5), 268–276. <https://doi.org/10.1097/HNP.0000000000000601>.
- Baydoun, M., & Barton, D. L. (2018). Complementary therapies for fatigue after hematopoietic stem cell transplantation: An integrative review. *Bone Marrow Transplantation*, 53(5), 556–564. <https://doi.org/10.1038/s41409-017-0073-5>.
- Billot, M., Daycard, M., Wood, C., & Tchalla, A. (2019). Reiki therapy for pain, anxiety and quality of life. *BMJ Supportive and Palliative Care*. <https://doi.org/10.1136/bmjspcare-2019-001775>.
- Birocco, N., Guillame, C., Storto, S., Ritorto, G., Catino, C., Gir, N., Balestra, L., Tealdi, G., Orecchia, C., De Vito, G., Giaretto, L., Donadio, M., Bertetto, O., Schena, M., & Ciuffreda, L. (2012). The effects of Reiki therapy on pain and anxiety in patients attending a day oncology and infusion services unit. *American Journal of Hospice and Palliative Medicine*, 29(4), 290–294. <https://doi.org/10.1177/1049909111420859>.
- Brewitt, B., Vittetoe, T., & Hartwell, B. (1997). The efficacy of Reiki hands-on healing: Improvements in spleen and nervous system function as quantified by electrodermal screening. *Alternative Therapies*, 3(4), 89.
- Brown, D. (2009). The energy body and its functions: Immunosurveillance, longevity, and regeneration. *Annals of the New York Academy of Sciences*, 1172(1), 123–139. <https://doi.org/10.1196/annals.1393.019>.
- Cancer Therapy Evaluation Program, (CTEP). (2017). *Common terminology criteria for adverse events (CTCAE) 5 version 5.0*. U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute.
- Demir Doğan, M. (2018). The effect of Reiki on pain: A meta-analysis. *Complementary Therapies in Clinical Practice*, 31, 384–387. <https://doi.org/10.1016/j.ctcp.2018.02.020>.
- Dyer, N. L., Baldwin, A. L., & Rand, W. L. (2019). A large-scale effectiveness trial of Reiki for physical and psychological health. *Journal of Alternative and Complementary Medicine*, 25(12), 1156–1162. <https://doi.org/10.1089/acm.2019.0022>.
- Hacıkamiloğlu, E., Gültekin, M., Boztaş, G., Dündar, S., Utku, E. Ş., Kavak Ergün, A., Sevinç, A., Tütüncü, S., Seymen, E., & Türkiye Halk Sağlığı Kurumu. (2017). Turkey Cancer Statistics 2017, Ministry of Health <https://hsgmdestek.saglik.gov.tr/tr/kanser-istatistikleri/yillar/2017-turkiye-kanser-i-istatistikleri.html>
- Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF). *Arthritis Care and Research*, 63(11), 240–252. <https://doi.org/10.1002/acr.20543>.
- Kenyon, M., & Babic, A. (Eds.). (2023). *The European Blood and Marrow Transplantation Textbook for Nurses*. Springer. <https://doi.org/10.1007/978-3-031-23394-4>.
- Lee, Y. C., Yeh, H. T., Lu, S. W., Tsai, Y. C., Tsai, Y. C., & Yen, C. C. (2024). Diagnostic accuracy of procalcitonin in adult non-neutropenic cancer patients with suspected infection: A systematic review and meta-analysis. *BMC Infectious Diseases*, 24(1), 278. <https://doi.org/10.1186/s12879-024-09174-7>.
- Ludwick, A., Corey, K., & Meghani, S. (2020). Racial and socioeconomic factors associated with the use of complementary and alternative modalities for pain in cancer outpatients: An integrative review. *Pain Management Nursing*, 21(2), 142–150. <https://doi.org/10.1016/j.pmn.2019.08.005>.
- Ma, J. D., El-Jawahri, A. R., LeBlanc, T. W., & Roeland, E. J. (2018). Pain syndromes and management in adult hematopoietic stem cell transplantation. *Hematology/Oncology Clinics of North America*, 32(3), 551–567. <https://doi.org/10.1016/j.hoc.2018.01.012>.
- Moher, D., Hopewell, S., Schulz, K. F., Montori, V., Gøtzsche, P. C., Devereaux, P. J., Elbourne, D., Egger, M., & Altman, D. G. (2010). CONSORT 2010 explanation and elaboration: Updated guidelines for reporting parallel group randomised trials. *BMJ (Clinical Research Ed.)*, 10(1), 28–55. <https://doi.org/10.1136/bmj.c869>.
- Okolo, O. N., & Gowin, K. (2019). Emerging role of integrative medicine in hematologic malignancies: A literature review and update on current trends in complementary medical practices in hematologic cancers. *Current Hematologic Malignancy Reports*, 14(4), 328–336. <https://doi.org/10.1007/s11899-019-00526-8>.
- Olson, K., Hanson, J., & Michaud, M. (2003). A phase II trial of Reiki for the management of pain in advanced cancer patients. *Journal of Pain and Symptom Management*, 26(5), 990–997. [https://doi.org/10.1016/S0885-3924\(03\)00334-8](https://doi.org/10.1016/S0885-3924(03)00334-8).
- Rubik, B., Brooks, A. J., & Schwartz, G. E. (2006). In vitro effect of Reiki treatment on bacterial cultures: Role of experimental context and practitioner well-being. *Journal of Alternative and Complementary Medicine*, 12(1), 7–13. <https://doi.org/10.1089/acm.2006.12.7>.
- Siegel, R. L., Miller, K. D., Wagle, N. S., & Jemal, A. (2023). Cancer statistics. *CA: A Cancer Journal for Clinicians*, 73(1), 17–48. <https://doi.org/10.3322/caac.21763>.
- Simpson, E., & Dazzi, F. (2019). Bone marrow transplantation 1957–2019. *Frontiers in Immunology*, 5(10), 124. <https://doi.org/10.3389/fimmu.2019.01246>.
- Smith, M. C., Reeder, F., Daniel, L., Baramée, J., & Hagman, J. (2003). Outcomes of touch therapies during bone marrow transplant. *Alternative Therapies in Health and Medicine*, 9(1), 40–49.
- Thrane, S., & Cohen, S. M. (2014). Effect of Reiki therapy on pain and anxiety in adults: An in-depth literature review of randomized trials with effect size calculations. *Pain Management Nursing*, 15(4), 897–908. <https://doi.org/10.1016/j.pmn.2013.07.008>.
- Utli, H., Dinç, M., & Utli, M. D. A. (2023). The effect of acupuncture or Reiki interventions on the levels of pain and fatigue of cancer patients receiving palliative care: A randomized controlled study. *Explore*, 19(1), 91–99. <https://doi.org/10.1016/j.explore.2022.11.007>.
- Wetzel, W. S. (1989). Reiki healing: A physiologic perspective. *Journal of Holistic Nursing*, 7(1), 47–54. <https://doi.org/10.1177/089801018900700109>.
- Wind, D., Phd, W., Associate, R., Engebretson, J., Rnc, D., Wardell, D. W., & Engebretson, J. (2001). Biological correlates of Reiki Touch(sm) healing. *Journal of Advanced Nursing*, 33(4), 439–445. <https://doi.org/10.1046/j.1365-2648.2001.01691.x>.
- Yun, H., Sun, L., & Mao, J. J. (2017). Growth of integrative medicine at leading cancer centers between 2009 and 2016: A systematic analysis of NCI-designated comprehensive cancer center websites. *Journal of the National Cancer Institute - Monographs*, 52, 29–32. <https://doi.org/10.1093/jncimonographs/lgx004>.
- Zucchetti, G., Candela, F., Bottigelli, C., Campione, G., Parrinello, A., Piu, P., Vassallo, E., & Fagioli, F. (2019). The power of Reiki: Feasibility and efficacy of reducing pain in children with cancer undergoing hematopoietic stem cell transplantation. *Journal of Pediatric Oncology Nursing*, 36(5), 361–368. <https://doi.org/10.1177/1043454219845879>.