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Phototherapy in pediatric patients: 5-years single center experience

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Abstract

Objective: Phototherapy is a treatment option that has been used for many years in the treatment of various skin diseases. While it has more widespread use in adult patients, its use is more limited in the pediatric age group due to the long-term risk of skin cancer. In our study, we would like to present the data of pediatric patients we treated in our phototherapy unit for 5 years.

Methods: Medical records of pediatric patients treated in our phototherapy unit between 01. January 2018 and 31 December 2022, were retrospectively reviewed. Age, gender, skin type, diagnosis, treatment duration, total number of sessions, cumulative doses, frequency of regularly treated patients, side effects, treatment response, and months of treatment were recorded.

Results: During this period 688 patients received phototherapy. Thirty-three (4.4%) of these patients were under the age of 18. Median age was 15 (3-17), female to male ratio was 19/14. Psoriasis (54.5%) was the most common diagnosis. Other diagnoses were vitiligo (18.2%), atopic dermatitis (15.2%), pityriasis lichenoides chronica (6.1%), alopecia totalis (3%), and pityriasis rubra pilaris (3%). 27 (81.8%) patients received cabin nbUVB, 5 (15.2%) local nbUVB, 1 local topical PUVA (3%). Side effects were observed in 4 patients (12.1%). Erythema was observed in 2 patients (6.1%), itching and dryness were observed in 1 patient (3.0%), and vesicular eruption on the face was observed in 1 patient (3.0%). Complete recovery was observed in 4 patients (12.9%), and partial recovery was observed in 11 patients (35.5%), while 16 patients (51.6%) did not benefit from the treatment.

Conclusion: Phototherapy was most commonly used in patients with psoriasis in the pediatric age group. The incidence of side effects was lower than similar studies in the literature. However, response rates to treatment were lower than those reported in the literature.

Keywords: Phototherapy; narrowband UVB; PUVA; childhood

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Introduction

Phototherapy has been used as a treatment option for a wide range of skin diseases since 1988 [1]. While it is more commonly used in adult patients, its use in the pediatric population is more limited due to insufficient long-term safety data and concerns about the risk of skin cancer [2,3]. Therefore, it is preferred for patients who do not respond to topical treatments or cannot receive systemic therapy due to side effects [4]. Phototherapy is most commonly used for the treatment of inflammatory skin diseases such as psoriasis, vitiligo, and atopic dermatitis in the pediatric population [3,4].

There are a limited number of studies presenting experiences of phototherapy in pediatric patient groups. Therefore, we aimed to retrospectively analyze data from pediatric patients treated in our phototherapy unit over a period of 5 years to identify similarities and differences with studies presented in the literature.

Methods

After obtaining ethical approval (Giresun Training and Research Hospital Clinical Research Ethics Committee. Approval Number: KAEK-70/Decision Number: 27.03.2023/08) and institutional permissions, we retrospectively reviewed the medical records of patients under 18 years of age who started treatment in our phototherapy unit and those whose treatment was discontinued for any reason between January 1, 2018, and December 31, 2022. The study was conducted in accordance with the principles of the Helsinki Declaration. Patient demographics, including age, gender, skin type, diagnoses, rates of patients receiving narrow-band ultraviolet B (nbUVB) and psoralen ultraviolet A (PUVA) phototherapy, rates of patients receiving local and cabin phototherapy, treatment durations, total number of sessions, cumulative doses, presence of side effects, rates of regular attendance to treatment sessions, and the months during which treatment was received, were recorded.

Patients who achieved complete resolution of all lesions with treatment were considered to have achieved a complete response. In patients with psoriasis, pityriasis lichenoides chronica (PLC), pityriasis rubra pilaris (PRP), and atopic dermatitis, improvement of 75% or more in lesions was considered a partial response, while in vitiligo patients, repigmentation of 50% or more of the lesions, and in alopecia areata patients, hair regrowth in more than 50% of the alopecic areas, were considered partial responses [5].

In our phototherapy unit, we utilize the Waldman UV 7002 cabin for UVA/dbUVB and the Waldman 182 for local nbUVB and UVA treatments (Waldman, 9W. Century Drive, Wheeling, IL 60090, USA). Treatment protocols for patients were planned by entering diagnosis and Fitzpatrick skin type data into the device's software program. In case of side effects or treatment interruptions, the energy provided could also be manually adjusted.

The normality of the obtained numerical data was examined using visual methods (histograms and probability plots) and analytical methods (Kolmogorov-Smirnov test). Since numerical ordinal data such as age, cumulative dose of dbUVB, and number of phototherapy sessions did not follow a normal distribution, median and minimum-maximum range were used for descriptive statistics analysis. Percentages were calculated for categorical variables.

Results

Between January 1, 2018, and December 31, 2022, a total of 688 patients received phototherapy in our unit. Among these patients, 33 (4.4%) constituted the under 18 age group. The median age of patients under 18 was 15 years (range: 3-17). Of these patients, 16 (48.5%) had Fitzpatrick skin type 2, and 17 (51.5%) had Fitzpatrick skin type 3. Among them, 19 (57.6%) were female, and 14 (42.4%) were male. The most common diagnosis of these patients was psoriasis, with 18 patients (54.5%). Six patients (18.2%) had vitiligo, 5 patients (15.2%) had atopic dermatitis, 2 patients (6.1%) had pityriasis lichenoides chronica (PLC), 1

patient (3%) had alopecia totalis, and 1 patient (3%) had pityriasis rubra pilaris (PRP).

Of the patients, 27 (81.8%) received cabin nbUVB phototherapy, while 5 (15.2%) received local nbUVB phototherapy (3 for psoriasis, 1 for vitiligo, and 1 for PRP). Only one patient (3%) received local PUVA therapy, a 12-year-old girl diagnosed with alopecia totalis. Due to the lack of improvement with treatment, the therapy was discontinued after 16 sessions (cumulative dose: 36.53 j/cm^2) for this patient.

The median total cumulative dose achieved by patients receiving nbUVB phototherapy was 10.4 j/cm^2 (range: 0.19-67.1), with a median total number of sessions 24.5 (range: 1-78). Among the patients, 78.8% (26 patients) completed at least 12 sessions of treatment, while 21.2% (7 patients) had their treatment discontinued before completing 12 sessions. Of the total, 16 patients (48.5%) attended their sessions regularly without interruption, whereas 17 patients (51.5%) either missed sessions or had irregular attendance during their treatment course.

All patients initially started treatment with three sessions per week. However, during the course of treatment, the therapy frequency was reduced to twice a week for 4 patients (12.1%), and subsequently, one patient's (3%) treatment was reduced to once a week before being discontinued. While 27 patients (81.8%) completed one treatment cycle, 6 patients (18.2%) received a second treatment cycle after their initial treatment was discontinued.

Four patients received phototherapy in combination with systemic treatment (12.1%). One patient received acitretin, one patient received azithromycin, and two patients received systemic steroid along with phototherapy. The 12-year-old male patient who received acitretin had a diagnosis of psoriasis. After receiving 6 sessions of cabin-type nbUVB therapy, the patient experienced partial improvement but discontinued treatment due to social reasons. The first patient who received systemic steroid was a 4-year-old girl diagnosed with vitiligo. Despite undergoing 54 sessions of nbUVB phototherapy, the patient did not benefit from the treatment. The other patient receiving systemic steroid was a 1-year-old girl diagnosed with atopic dermatitis. After receiving 8 sessions of treatment, she discontinued phototherapy due to non-attendance, also showing only partial response to treatment. The 16-year-old female patient diagnosed with PLC and receiving azithromycin did not benefit from 61 sessions of nbUVB phototherapy.

Four patients (12.1%) experienced side effects. Among these, two patients (6.1%) reported erythema, one patient (3.0%) reported itching and dryness, and one patient (3.0%) exhibited vesicular eruption on the face. Treatment was discontinued in two patients (6.1%) due to side effects (Table 1).

Upon examining the distribution by month, it was observed that more pediatric patients underwent phototherapy in July and August compared to other months (Figure 1).

Upon examining the rates of benefit obtained from the treatment, data from 31 patients were available. Full recovery was observed in 4 patients (12.9%), partial improvement was noted in 11 patients (35.5%), while 16 patients (51.6%) did not benefit from the treatment. Data on treatment response were not available for 2 patients.

When analyzing treatment responses according to diagnostic groups, complete response was only achieved in the psoriasis group (23.5% - 4 patients), while partial response was observed in 7 patients (41.2%). In the vitiligo group, partial response was seen in 1 patient, in the atopic dermatitis group, partial response was observed in 2 patients, and in one PRP-diagnosed patient, partial response was noted. However, none of the patients diagnosed with alopecia totalis and PLC benefited from the treatment (Table 2).

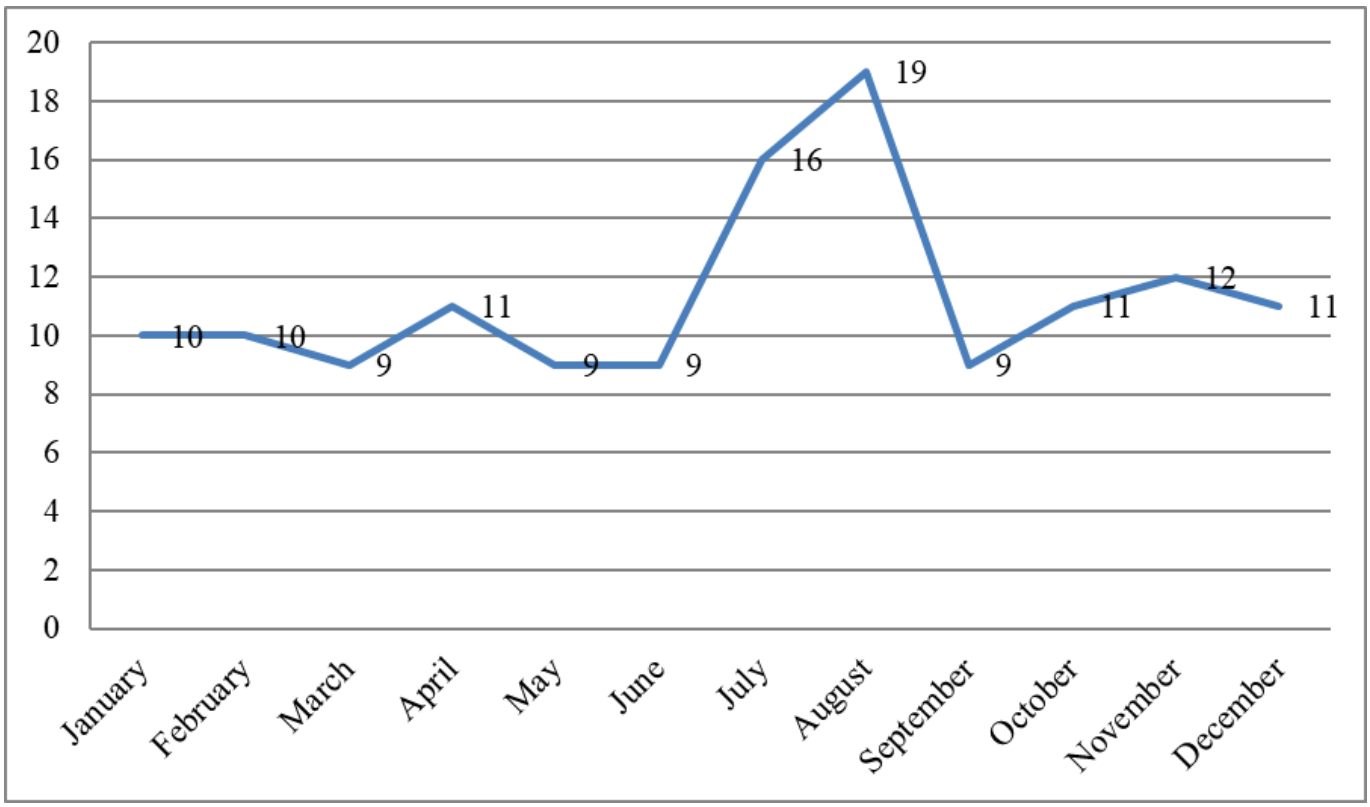

Figure 1: Number of patients receiving phototherapy by month

Table 1: Demographic data of pediatric patients receiving phototherapy

Demographic data of pediatric patients receiving phototherapy		
Age (year) -median (minimum-maximum)		15 (3-17)
Gender	Female	19 (57.6%)
	Male	14 (42.4%)
Fitzpatrick skin photo type	2	16 (48.5%)
	3	17 (51.5%)
Diagnoses	Psoriasis	18 (54.5%)
	Vitiligo	6 (18.2%)
	Atopic dermatitis	5 (15.2%)
	Alopecia totalis	1 (3%)
	Pityriasis lichenoides chronica	2 (6.1%)
	Pityriasis rubra pilaris	1 (3%)

Phototherapy type	Cabin nbUVB	27 (81.8%)
	Local nbUVB	5 (15.2%)
	Local PUVA	1 (3.0%)
nbUVB cumulative dose –joule/cm^2 -median (minimum-maximum)		10.4 (0.19-67.1)
nbUVB total number of sessions -median (minimum-maximum)		24.5 (1-78)
PUVA cumulative dose – joule/cm^2		36.53
PUVA total number of sessions -median		16
Number of patients treated regularly without interruption of treatment regularly- n (%)		16 (48.5%)
Number of patients who interrupted their treatment / could not receive regular treatment- n (%)		17 (51.5%)
Number of courses	**Patients received 1 course of treatment - n (%)**	27 (81.8%)
	Patients received 2 courses of treatment - n(%)	6 (18.2%)
Number of treatments per week	**3 per week –n (%)**	33 (100%)
	2 per week- n(%)	4 (12.1%)
	1 per week- n (%)	1 (3%)
Adverse effects- n(%)		4 (12.1%)
– Erythema-n(%)		2 (6.1%)
– Pruritus and xerosis-n(%)		1 (3%)
– Vesicles on face-n(%)		1 (3%)

nbUVB: narrow band ultraviolet B**, PUVA:** Psoralen ultraviolet A

Table 2: Phototherapy response rates according to diagnoses

Response rate (number of patients whose data were accessed / total number of patients)	Complete recovery (%)	Partial recovery n (%)	No benefit n (%)
Psoriasis (17/18)	4 (23.5%)	7 (41.2%)	6 (35.3%)
Vitiligo (5/6)	0	1 (20%)	4 (80%)
Atopic dermatitis (5/5)	0	2 (40%)	3 (60%)
Alopecia totalis (1/1)	0	0	1 (%100)
Pityriasis rubra pilaris (1/1)	0	1 (100%)	0
Pityriasis lichenoides chronica (2/2)	0	0	2 (100%)

Table 3: Comparison of treatment response rates reported in the literature

	Psoriasis % (n)	Vitiligo % (n)	Atopic dermatitis % (n)	Alopecia areata % (n)	Pityriasis lichenoides chronica % (n)	Pityriasis rubra pilaris % (n)
Our study	64.3% (9)	20% (1)	33.3% (1)	0	0	100% (1)
Slimani et al [2]	73%	50%	68%	-	-	-
Ersoy-Evans et al [8]	92.9% (26)-nbUVB 83.8% (5)-PUVA 93.3% (28)-UVB	50% (4)-nbUVB 57% (4)-PUVA	-	-	83.3% (10)	-
Jury et al [10]	63% (22)		68% (17)	0	100% (2)	100% (1)
Brazelli et al [9]					100% (5)	
Brazelli et al [12]		80% (8)				
Pavlovsky et al [11]	92% (73)		69% (25)			

nbUVB: narrow band ultraviolet B, **PUVA:** Psoralen ultraviolet B, **UVB:** Ultraviolet B

Discussion

Phototherapy is a convenient and effective treatment option. It serves as a safe therapeutic alternative, particularly for patients who cannot undergo systemic treatment due to potential side effects or do not respond to topical therapies [6]. While more commonly preferred in adult patients, phototherapy can also be used in pediatric dermatology for the treatment of various skin conditions such as psoriasis, vitiligo, atopic dermatitis, and mycosis fungoides. In pediatric dermatology, devices incorporating UVB and UVA wavelengths are primarily used for treatment [4,7].

There is a limited amount of literature available on the use of phototherapy in the pediatric population. All published data are derived from retrospective studies. There are no prospective randomized controlled trials conducted on this subject. Additionally, there is no treatment guideline available specifically for pediatric phototherapy protocols. Therefore, treatment parameters and dosages have not been standardized in the pediatric age group [8].

One of the largest and most recent studies examining phototherapy in the pediatric age group was published by Slimani et al. in 2020. In this study, medical records of 90 pediatric patients were retrospectively analyzed covering 36 years of data [2]. While patients under the age of 16 were included in Slimani et al.'s study, our study included patients under the age of 18. In Slimani et al.'s study, 38% of patients received treatment for generalized psoriasis, 14% for palmoplantar psoriasis, 19% for vitiligo, 11% for atopic dermatitis, 9% for pruritus/prurigo, and 9% for alopecia areata. The distribution of diagnoses among patients in our study was similar to their findings. However, none of our patients received phototherapy for pruritus, unlike in Slimani et al.'s study. The mean cumulative treatment dose and mean number of sessions for patients receiving nbUVB therapy were reported as 10.8 j/cm2 and 20, respectively, in Slimani et al.'s study. In our study, the median cumulative dose was 10.4 j/cm2 (range: 0.19-67.1), and the median number of sessions was 24, which were comparable results. In Slimani et al.'s study, 14% of patients (approximately 12 patients) received local PUVA therapy, whereas only one of our patients received local PUVA therapy. There were no patients receiving systemic PUVA therapy in both studies. Additionally, in Slimani et al.'s study, mild erythema was observed in 15% of patients as a side effect, while this rate was slightly lower in our study (6.1%). In Slimani et al.'s study, 32% of patients discontinued their treatment, whereas 78.8% of our patients received at least 12 sessions of treatment, and 21.2% (7 patients) discontinued treatment before completing 12 sessions.

The largest study conducted in our country about this topic was carried out by Ersoy Evans et al. in 2008 [5]. In this study, the data of pediatric patients under the age of 18 receiving phototherapy over a period of 20 years were examined, and 113 patients were included in the study. The distribution of diagnoses among patients in Ersoy Evans et al.'s study showed similarities to our study. Psoriasis was reported as the most frequent diagnosis, as in our study (53.5%). However, unlike our study, there were also patients diagnosed with mycosis fungoides, lichen planus, and parapsoriasis in their study. Additionally, unlike our study, 21% of the patients received systemic PUVA therapy. In this study, the mean or median number of sessions for treatment response was also calculated. These numbers were reported as 16±6.6 sessions for psoriasis (nbUVB), 14 sessions (range: 9-107) for vitiligo (nbUVB), and 22 sessions for PLC (nbUVB).

In the present study, the highest response rate to treatment was observed in the psoriasis patient group (64.3%). Comparative results of phototherapy response rates in pediatric patient groups reported in the literature are provided in Table 5 [2, 5, 9-12]. Compared to other studies, we found lower treatment success rates in our patients. Possible reasons for this could include our smaller sample size; the retrospective nature of the study, which relied on patient files and statements for data collection, thus not accessing the true data of each patient; initiating treatment based on skin type rather than minimal erythema dose and minimal phototoxic dose; the need to reduce the energy given due to the fact that 51.5% of patients interrupted treatment at least once, and the time it takes to reach the maximum energy level.

The most commonly observed side effect of phototherapy is mild self-limiting erythema. In addition to this, xerosis, pruritus, and gastrointestinal symptoms in PUVA recipients are other possible side effects. Long-

term side effects include carcinogenesis, cataracts, lentigines, and photoaging. The relationship between UV exposure and skin cancer has been demonstrated in many studies. The carcinogenic risk of PUVA therapy is higher compared to UVB phototherapy [13]. In our study, we observed side effects in 4 patients (12.1%). Treatment was discontinued in 2 patients due to side effects (6.1%). In the study by Ersoy Evans et al., side effects were observed in 75.6% of patients receiving dbUVB (51.6% erythema, 18% pruritus, 9% burning) [5]. In the study by Jury et al., erythema was observed in 30% of cases, while vesicular eruptions were detected in 5 patients (6.4%) (2 hydroa vacciniforme, 2 herpes, 1 varicella reactivation) [10]. In the study by Slimani et al., mild erythema was observed in 15% of patients [2]. The incidence of side effects in our study was lower compared to other studies. We could not access long-term side effect data as patients did not attend follow-up visits.

The main limitation of our study is its retrospective nature, which prevented us from accessing complete patient data. Since we did not measure treatment responses using quantitative methods such as the affected body surface area or PASI response, we could not obtain objective data in this regard. Additionally, our clinic is relatively new compared to other clinics, so we only have data spanning a period of 5 years. Therefore, the number of patients in our study is lower compared to other large-scale studies.

Conclusion

Phototherapy has been most commonly administered in pediatric patients diagnosed with psoriasis. The frequency of observed side effects was found to be lower compared to similar studies in the literature. However, treatment response rates were also determined to be lower compared to similar studies. We believe that prospective, larger-scale, and multicenter studies are needed to determine the long-term efficacy and side effects of phototherapy in pediatric patients.

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