

## Importance of Follow-Up Microscopic Examination in Hospitalized Patients with Confirmed Scabies

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**Abstract.** We investigated the duration of positive microscopic examination in hospitalized patients with confirmed scabies in an acute care hospital. We included hospitalized patients who were diagnosed with scabies between January 2015 and June 2019. From the study period, a total of 31 patients with confirmed scabies were identified. Median age was 75 years. Of a total of 31 patients with confirmed scabies, six were discharged or transferred before getting a negative microscopic test result. Of the remaining 25 patients with negative microscopic test results, the median duration from diagnosis to a negative microscopic test result was 14 days (interquartile range, 9–17). Given that nosocomial outbreaks lead to high workload and considerable resource consumption, adequate treatment, sufficient follow-up examination, and confirmation of cure are warranted before releasing contact isolation.

Scabies is a common contagious disease caused by infestation with mites of the *Sarcoptes scabiei* variety *hominis*. Patients with scabies are instructed to apply two doses 1–2 weeks apart of scabicide topical creams,<sup>1</sup> and the CDC recommends contact precautions for at least 8 hours after initiating effective treatments.<sup>2</sup> However, we have frequently experienced treatment failure after one or two applications of topical creams, and there are limited data regarding the optimal number of treatments, duration of the follow-up period, and duration of contact precaution. We thus investigated the duration of positive microscopic examination results in patients with confirmed scabies treated at an acute care hospital in Seoul, Korea.

This study was performed at Asan Medical Center, a 2,700-bed tertiary care hospital in Seoul, Republic of Korea. The medical records of hospitalized patients who were diagnosed with scabies between January 2015 and June 2019 were retrospectively reviewed. This study was approved by the Institutional Review Board of Asan Medical Center (No. 2020-0016), which waived the need for informed consent based on the retrospective nature of the study.

We implemented an active scabies screening program for all newly admitted patients. Any patient who had visited another healthcare facility including long-term care facilities within the preceding month and had symptoms of itch or rash were immediately placed on contact precautions with gown and glove and referred to a dermatologist.

In 2015, patients with confirmed scabies were treated with 1% lindane cream every other day for a total of four times. After the introduction of the permethrin cream in 2016, patients were treated with 5% permethrin (Omecclean<sup>®</sup>, Dae Woong, Seoul, Republic of Korea) or lindane cream four times every third day until March 2017. From April 2017 and on, patients were treated with 5% permethrin cream (Omecclean) on days 0, 1, 4, and 5 (one cycle). As we had experienced treatment failure frequently and

concerned for incorrect application of topical creams, these therapy schedules have been modified from recommendation of treatment for crusted scabies that is usually treated with topical permethrin every 2–3 days for 1–2 weeks.<sup>3</sup> Patients were instructed to apply the cream to the whole body except for face and head, and wash off after 8–12 hours. To prevent reinfection, all household members—whether symptomatic or not—were simultaneously treated with the patient. Follow-up microscopic examination was performed 1 week after the first day of treatment (day 7), and if the results were positive, the patients were treated with an additional cycle of scabicide creams and followed up weekly until getting a negative microscopic test result. If the results of the follow-up microscopic examination were negative, the dermatologist confirmed that the scabies was cured and discontinued the contact precaution.

We collected the following patient data: age, gender, history of residence in long-term care facilities, symptoms (rash or itch) at admission, interval between admission and diagnosis, number of treatments, and duration of contact precaution. We also investigated the duration of positive microscopic examination results in patients with confirmed scabies.

Fisher's exact test was used to compare between categorical variables. Median time from diagnosis to a negative microscopic examination result was analyzed using Kaplan–Meier survival analysis. Patients who did not undergo follow-up microscopic examination because of death, discharge, or transfer were categorized as censored patients. The log-rank test was used to determine the significance of the difference between permethrin-treated group and lindane-treated group. *P* values less than 0.05 were considered statistically significant. Statistical analysis was performed using GraphPad Prism 5.01 (GraphPad Software, Inc., La Jolla, CA) and MedCalc statistical software version 18.10.2 (MedCalc Software bvba, Sotend, Belgium).

A total of 31 patients with confirmed scabies were treated at our center during the study period (Table 1), one of whom had suspected crusted scabies. The median age was 75 years, about half were long-term care facility residents. Of the total 31 patients, eight (26%) initially had negative microscopic examination results but later had positive results in the follow-up examinations (Figure 1). Six patients discharged or transferred before getting negative follow-up microscopic examination

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TABLE 1

Characteristic	Values
Age (years), median (IQR)	75 (61–81)
Male	18 (58)
Previous residence at long-term care facilities	16 (52)
Symptoms (rash or itch) at admission	12 (39)
Days from admission to diagnosis of scabies, median (IQR)	4 (2–13)
Topical treatment regimen	
1% Lindane cream	7 (23)
5% Permethrin cream	22 (71)
Both	2 (6)
Number of treatments, median times (IQR)	6 (4–8)
Conversion of microscopic examination results (from negative to positive)	8 (26)
Positive microscopic examination more than two times	11 (35)
Median days from diagnosis to the last positive microscopic results (IQR)	7 (6–13)
Negative microscopic examination results available	25 (81)
Median days from diagnosis to negative microscopic results (IQR)*	14 (9–17)
Duration of contact precaution (days), median (IQR)	15 (14–22)

IQR = interquartile range. Data are presented as the number (%) of patients unless otherwise indicated.

\* Twenty-five patients who had negative microscopic examination results were analyzed.

results, and the remaining 25 patients had negative microscopic test results after treatment. Of the 25 patients, nine (36%) had at least two consecutive positive microscopic tests. The median interval from diagnosis to negative microscopic test results was 14 (interquartile range [IQR], 9–17) days in 25 patients with negative microscopic test results. The Kaplan–Meier curve for negative microscopic examination results in patients with confirmed scabies is shown in Figure 2. The median duration of contact precaution was 15 (IQR, 14–22) days.

Of the seven patients who were treated with lindane cream only, four (57%) had two consecutive positive microscopic test results; by contrast, six (27%) of the 22 patients who were treated with permethrin cream only had two consecutive positive microscopic test results ( $P = 0.19$ ). Kaplan–Meier curves showed that there was no significant difference in the prevalence of positive microscopic results between patients treated with lindane and those treated with permethrin cream (log-rank  $P = 0.98$ ; Supplemental Figure 1).

In our cohort, approximately one-third of the patients who were treated with four applications of scabicide creams had persistent microscopic test results after 1 week. The median

number of days between diagnosis and negative microscopic test results was quite high as 14, and the duration of contact precaution was also long (15 days). Our results support the notion that one cycle (four times of application) of topical cream may be insufficient for treating scabies.

The current drug of choice for scabies is 5% permethrin, which kills both the mites and the eggs.<sup>4</sup> To kill any mites that were not exposed during the first treatment, a subsequent application of scabicide cream after an interval of 1 week is generally recommended.<sup>3</sup> However, a previous study showed that a single application of permethrin was also effective in 97.8% of patients,<sup>5</sup> whereas another study reported that two applications of permethrin were effective in 92.5% of patients.<sup>4</sup> In our study, one-third of patients had treatment failure even after four times of topical cream application (days 0, 1, 4, and 5). Treatment failure may be due to incorrect application (no application to head) or failure to treat all contacts. Resistance to permethrin is also possible, as *in vitro* studies have shown that susceptibility to permethrin is progressively reduced with administration.<sup>6</sup> Bernigaud et al.<sup>7</sup> showed that pure permethrin was not ovicidal, whereas commercial 5% permethrin creams (Lyclear and topiscab) were ovicidal. In addition, after 12-hour exposures of commercial 5% permethrin creams, egg hatchability was increased 10–12%.<sup>7</sup> Commercial 5% permethrin cream (not pure permethrin) sold in Korea may not be ovicidal. To our knowledge, there have been no data regarding this Korean commercial permethrin cream is ovicidal. Similar to our findings, Park et al.<sup>8</sup> reported that the median time to cure was 15 days with a median of three times of treatment. In addition, elongation of the application interval may be needed considering the elimination half-life and the incubation time of the mite eggs (15 days), and it may be reasonable to retreat the patients after 2 weeks.

Although the number of patients was small, we did not observe significant differences between permethrin and lindane cream regarding the time to negative microscopic examination results (Figure 2). This is in line with the results of a previous study in which complete resolution occurred in 181 (91%) of 199 patients treated with permethrin and in 176 (86%) of 205 patients treated with lindane.<sup>9</sup> However, another study on 220 patients reported that permethrin was superior to lindane in terms of the rate of improvement (84% versus 49%).<sup>10</sup> Because of the potential neurotoxicity of lindane, permethrin is the preferred agent, and we have treated with permethrin.

The recent guideline from the CDC recommends avoiding skin-to-skin contact with patients with scabies for at least 8 hours after application of scabicide treatment in cases of the classic scabies.<sup>2</sup> However, our findings on the long infestation,

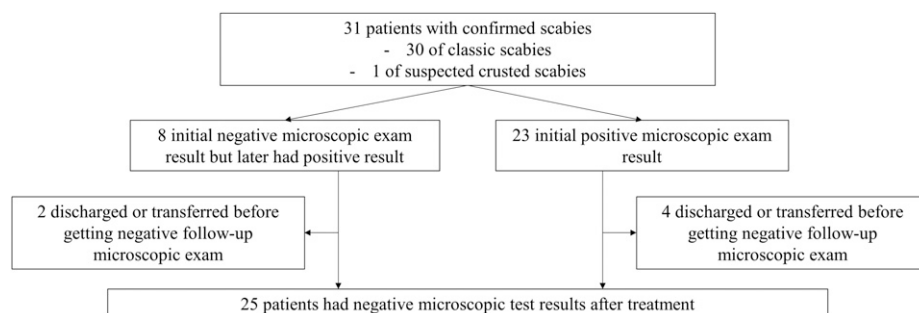


FIGURE 1. Flowchart of patients included our study.

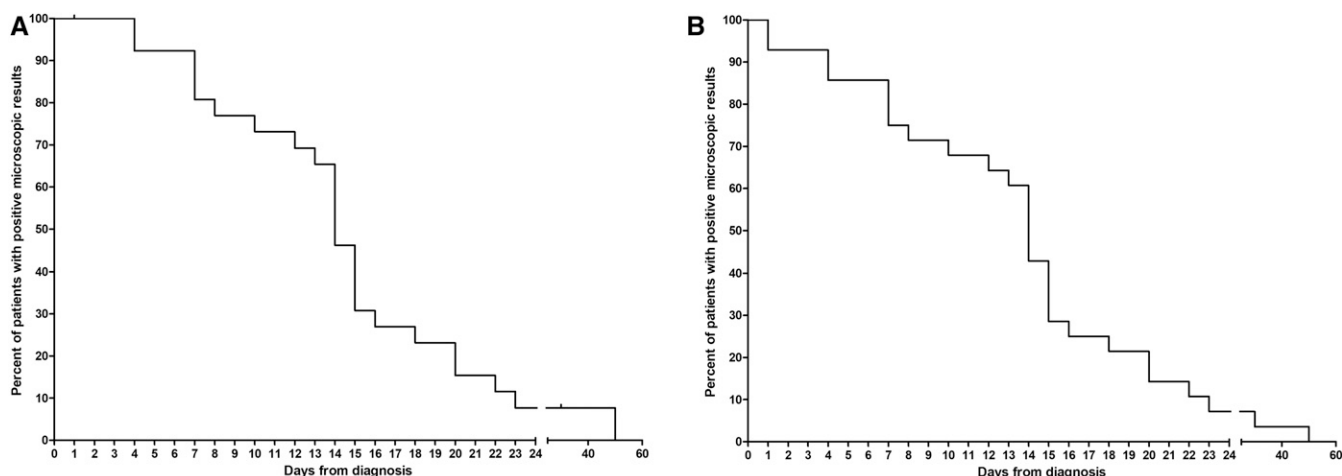


FIGURE 2. Kaplan–Meier curve for negative microscopic examination of confirmed scabies. (A) Percentage of patients with positive microscopic examination results after diagnosis and (B) percentage of patients with positive microscopic examination results after diagnosis when censored patients were considered to have negative results.

despite several applications of scabicide treatment, suggest that a longer duration of contact precaution is needed. Because scabies outbreaks in healthcare facilities result in significant burdens, early release of precaution should be carried out with caution and confirmation of a negative microscopic examination result before discontinuing contact precaution is advisable.

There are some limitations to note in this study. The single-center nature of this study limits the generalization of its findings; however, the doubtful efficacy of a single application of scabicide had been reported in a previous study,<sup>8</sup> so a further study is warranted. Second, obtaining a high-quality skin scraping sample is largely dependent on the expertise of the specialist, and the sensitivity of microscopic examination from skin scraping samples can be as low as 50%.<sup>11</sup> Therefore, it is possible that the incidence of negative follow-up microscopic examination results was overestimated. To solve this problem, a more accurate diagnostic method is needed. Finally, as it was retrospective study, only nine patients with classic scabies had records of the number of mites and eggs, showing low parasitological load. We have no data regarding the number of mites or eggs in about two-thirds of patients, and if they had high mite load, they cannot be treated with a treatment for common scabies. This may be associated with lower efficacy of scabicide cream in our study.

In conclusion, approximately one-third of patients with scabies had persistent positive results in microscopic examination even after multiple applications of topical creams. Considering that nosocomial outbreaks lead to high workload and considerable resource consumption, adequate treatment and follow-up examination are necessary, and early release of contact precaution should be carried out with caution.

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