



## Original article

# Severe kyphosis as a risk factor of umbilical trichophytosis in elderly people

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## Abstract

**Objective:** To determine whether severe kyphosis is one of the risk factors of umbilical trichophytosis in elderly people.

**Patients and Methods:** Four cases with umbilical trichophytosis in the last 3 years and all 143 patients who visited to our clinic during from April 2018 to March 2019 were included in this study. The relationship between the condition of umbilical region and kyphosis was investigated. As regards the levels of senile kyphosis, simple visual classification of the kyphosis method was used (Level 0–4).

**Results:** All four cases with umbilical trichophytosis were elderly women aged  $\geq 80$  years, had severe kyphosis, skin overlaps, filthy umbilical region, and lumps of dirt in the umbilical region and had nail tinea. Only two cases had umbilical trichophytosis among 143 patients who visited our clinic during the 1 year study period, with incidence is of 1.4%/year. About 65.7%, 60%, and 37.1% of 35 patients with kyphosis with forward-bent posture had skin overlap, moist, and filthy umbilical regions, respectively. However, these symptoms were not found in patients without severe kyphosis.

**Conclusion:** Severe kyphosis with forward-bent posture could be one of the risk factors of umbilical trichophytosis in elderly people.

**Key words:** umbilical region, trichophytosis, kyphosis, elderly people

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## Introduction

Skin trichophytosis including the foot and hair, is very well known, even in developed and developing countries<sup>1</sup>. However, umbilical trichophytosis is classified as trichophytosis corporis, with incidence reported to be 0.68% in all trichophytosis<sup>2</sup>. Consequently, umbilical trichophytosis would be extremely rare. Trichophytosis more commonly occurs in elderly people than that in younger patients<sup>3</sup>. Ku-

makogen town is located in the Southwest Part of Shikoku Mountains of Japan. In this area, the population density is progressively decreasing with an increase in aging population. About 47% of the population of this area are over 65 years old<sup>4</sup>.

Recently, two patients with umbilical trichophytosis lesions were presented to Fujimine clinic, Kumakogen town, Ehime, Japan, in the last year, and four with umbilical trichophytosis were found during in the last 3 years. All four patients with umbilical trichophytosis were aged  $\geq 80$  years, with skin overlap, moist, and filthy umbilical regions due to severe kyphosis and trichophytosis in the foot or nail. Reports showed that farmers in the farm village suffered from severe kyphosis<sup>5</sup>. Thereupon, the incidence of kyphosis, skin overlap, moist, and filthy umbilical regions was examined in patients who visited Fujimine clinic in the last year (from April 2018 to March 2019) in present study. Therefore, this study primarily aimed to assess whether severe kyphosis is a risk factor for umbilical trichophytosis.

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**Table 1** Summary of clinical manifestations of 4 cases with umbilical trichophytosis

Case	1	2	3	4
Sex	Female	Female	Female	Female
Age	80	86	84	92
Season of onset	April	June	May	Feb
Body weight (kg), BMI	31, 18.3	53, 23.8	45, 22	27, 17
Nutrition state	Slightly poor	Good	Good	Poor
Serum Alb. Level (g/dL)	3.8	3.9	3.8	3.6
WBC	4,970	5,890	4,810	3,900
Lymphocyte	1,322 (26.6%)	1,785 (32%)	2,208 (46%)	580 (16%)
Complication of diabetes	(-)	(-)	(-)	(-)
Kyphosis (Level)	Severe (4)	Severe (4)	Severe (3)	Severe (4)
Forward-bent posture	≥90°	≥90°	≥45°	≥90°
Condition of umbilical region	Skin overlap moist, filthy	Skin overlap moist, filthy	Skin overlap moist, filthy	Skin overlap moist, filthy
Trichophytosis in other organs	Foot, nail, hands pubic region	Foot, nail	Foot, nail	Foot, nail
Lesions range	Entire abdomen	Localized range of radius 5 cm	Localized range of radius 5 cm	Localized range of radius 5 cm
Cleaning of umbilical region	Day service bathing 1/week	Day service bathing 1/week	Wash herself every day	No bathing for 1 month
Treatment	Lulicozole	Ketoconazole	Ketoconazole	Ketoconazole
Relapse	4 times	2 times	2 times	No for 6 months
Prognosis	Died at 84 y/o	Live	Live	Died at 92 y/o
Living with	Husband	Husband	Alone	Son
Visiting nursing & care management	(-)	(-)	(-)	(-)

## Patients and Methods

Patients with umbilical trichophytosis in Fujimine clinic were examined for the last 3 years (Table 1). Trichophytosis was diagnosed only based on clinical features as described: skin lesion, existence of nail and/or foot trichophytosis, and effect with antifungals. No direct evidence was found for the diagnosis of trichophytosis, such as the direct microscopic examination of clinical samples, histopathology, culture, and serology<sup>6</sup>.

Patients who visited the Fujimine Clinic in the last year (from April 2018 to March 2019) were examined, and the incidence of kyphosis (Level 2–4 shown in Figure 1), skin overlap, moist and filthy umbilical regions, nail and/or foot trichophytosis, diabetes mellitus, nutritional state, and body mass index (BMI) were also investigated.

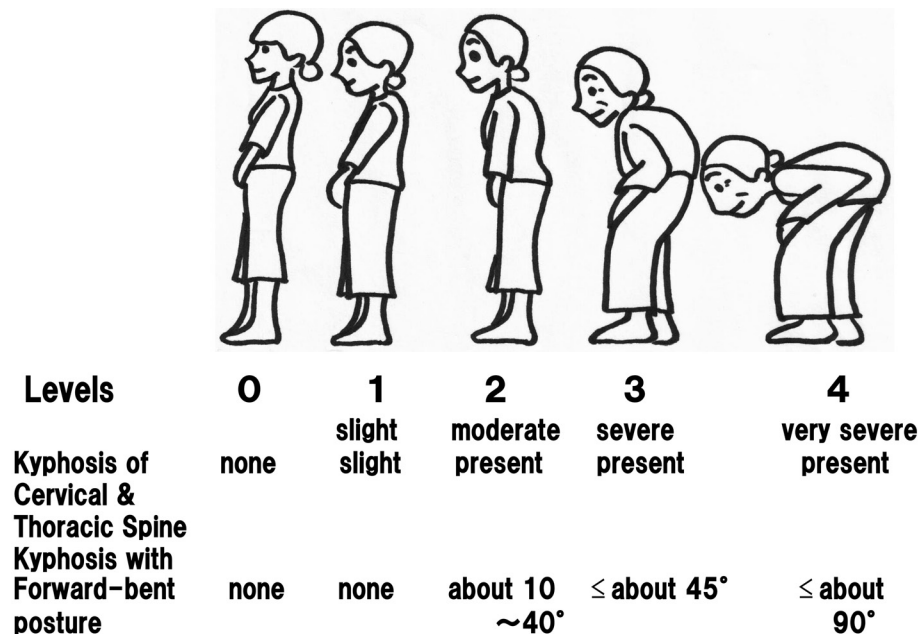
A total of 143 patients who visited the clinic from April 2018 to March 2019 were included. As regards the levels of senile kyphosis, visual classification of kyphosis method was used, because it is very convenient without training examiners using a specialized equipments such as X-rays. Our visual classification of kyphosis was performed by Dr. Onji and Mrs. Amano (nurse), independently observing patient's natural walking ability in the clinic. The levels of kyphosis were graded as no kyphosis (Level 0), the slight kyphosis

(Level 1) without forward-bent posture, moderate kyphosis (Level 2) with forward-bent posture (approximately 10–40° of the lumbar spine), severe kyphosis (Level 3) with forward-bent posture (≥ approximately 45° of the lumbar spine), and very severe kyphosis (Level 4) with forward-bent posture (≥ approximately 90° of lumbar spine) (Figure 1). The forward-bent posture in Levels 2, 3, and 4 were measured by eyes, based on the angle between the line connecting the part of 7th cervical and 5th lumbar spinous processes, and the vertical line through 5th lumbar process. Although our method is one of the visual classifications of kyphosis in the Kurabuchi study described in 2019<sup>7</sup>, our method was independent of this report.

The incidences of skin overlap, moist and filthy umbilical region, nail and/or foot trichophytosis were compared between 15 patients without kyphosis (Level 0 and 1) and 35 with kyphosis (Level 2, 3, and 4) (Figure 2). As regards the patients who visited Fujimine clinic, the incidence of kyphosis was investigated from April 2018 to March 2019 (Figure 3).

For statistical processing, a  $\chi^2$  test was used, and a significant difference test was conducted at a significance level of less than ( $\leq$ ) 5%.

The present study was approved by Kumakogen Town Hospital Ethics Committee (approval number I-1-2018).



**Figure 1** Visual classification of kyphosis levels.

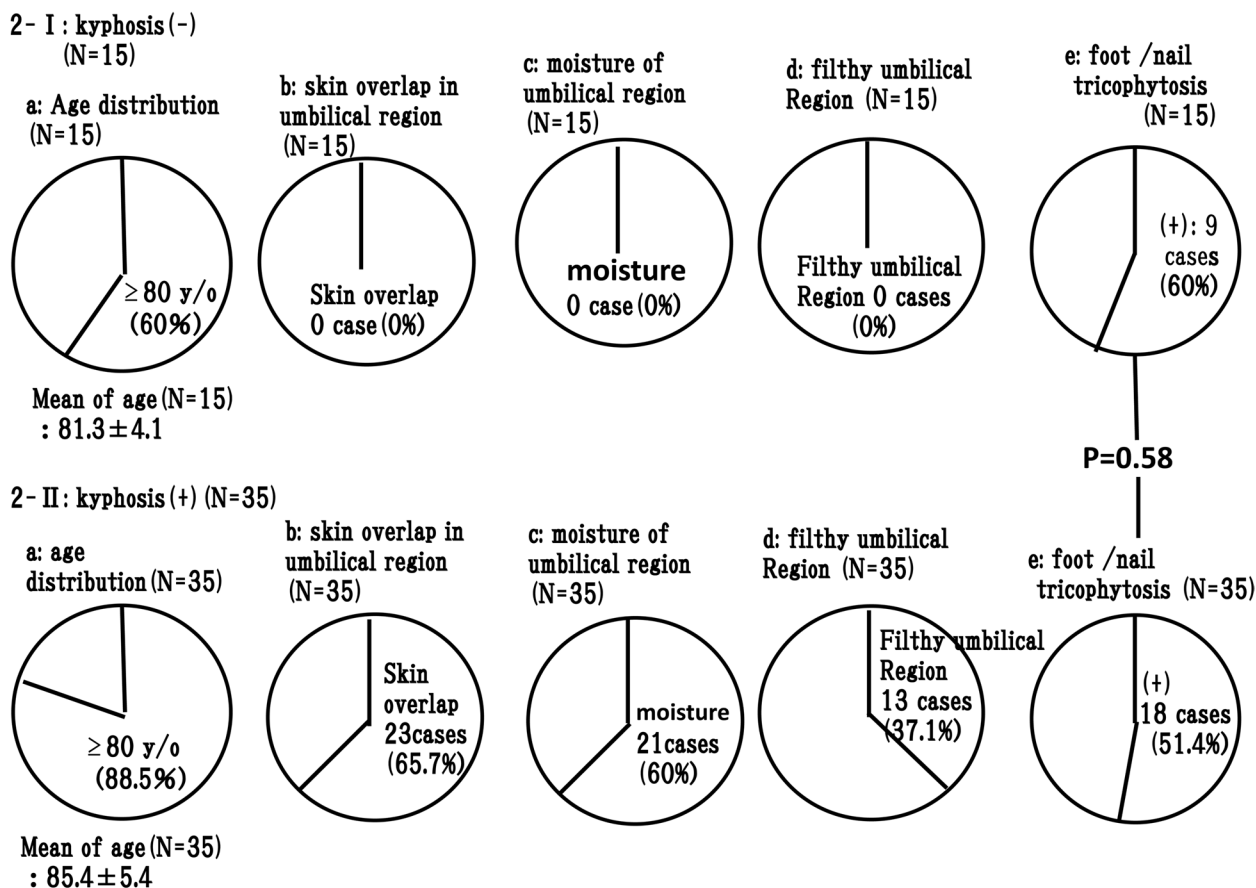
Our visual classification of kyphosis was performed by observing patient’s normal walking ability in the clinic. The kyphosis levels are no kyphosis (Level 0), very slight kyphosis without forward-bent posture (Level 1), moderate kyphosis with forward-bent posture (approximately 10°–40° of the lumbar spine) (Level 2), severe kyphosis with forward-bent posture (more than (≥) approximately 45° of the lumbar spine) (Level 3), and very severe kyphosis with forward-bent posture (more than (≥) approximately 90° of the lumbar spine) (Level 4). The forward-bent posture in Levels 2, 3, and 4 were measured by eyes, based on the angle between the line connecting the part of 7th cervical and 5th lumbar spinous processes, and the vertical line through 5th lumbar process. The forward-bent posture in Levels 2, 3, and 4 were measured by eyes, based on the angle between the line connecting the part of 7th cervical and 5th lumbar spinous processes, and the vertical line through 5th lumbar process.

## Results

Four cases of umbilical trichophytosis were identified for the last 3 years in Fujimine Clinic, although umbilical trichophytosis rarely occurs. All data of 4 cases are shown on Table 1. Among the four cases of umbilical trichophytosis, three had the skin lesions of trichophytosis localized in a radius of about approximately 5 cm of the umbilical region, although the skin lesion of umbilical trichophytosis usually occurs as part of trichophytosis in the abdomen and/or perineum. All cases were the elderly women aged ≥80 years old, had severe kyphosis (Level 3–4), skin overlaps, filthy umbilical region and lumps of dirt in the umbilical region and nail and/or foot trichophytosis. Umbilical trichophytosis lesions were improved with anti-fungal administration for 4 weeks, but the recurrence was observed in 3 of 4 cases. In 2 of 4 cases, BMI was within normal limits. Two of 4 cases had poor nutritional status, but their blood albumin levels were within normal limits. No case had diabetes mellitus. No case was gotten underwent the regular medical cares at

home by a professional care manger. The keyperson for their cases at home were their husbands or son.

The number of patients visited the clinic was 143 for the 1 year (April 2018 to March 2019). Factors related with kyphosis, which should be considered as a risk factor of umbilical trichophytosis, were compared between 35 patients with moderate–severe kyphosis (Levels 2–4), and 15 patients without kyphosis (Level 0–1), (Figure 2). All four cases with umbilical trichophytosis had very severe kyphosis (Level 3, 4). The difference in ages among four cases of umbilical trichophytosis ( $85 \pm 5.0$ ,  $n=4$ ) and 35 patients with kyphosis ( $85.4 \pm 5.4$ ,  $n=35$ ) was not significant ( $P=0.78$ ). Age of 35 patients ( $85.4 \pm 5.4$ ) with kyphosis (Level 2–4) is significantly higher than those 15 patients without severe kyphosis (Level 0–1) ( $81.3 \pm 4.1$ ) ( $P<0.01$ ) (Figure 2). The difference in the incidence of foot/nail trichophytosis between 15 patients without kyphosis and 35 patients with kyphosis was not significant ( $P=0.58$ ) (Figure 2). These data could suggest that the kyphosis is a more important risk factor of umbilical trichophytosis than age.



**Figure 2** Difference of factors related to kyphosis between with and without kyphosis.

Factors related with kyphosis (Level 3–4), which should be considered as a risk factor of umbilical trichophytosis were compared between 35 patients with and 15 without kyphosis, who visited Fujimine clinic during the 1- year study period, from April 2018 to March 2019. Age of 35 patients (age:85.4 ± 5.4) with kyphosis is significantly higher than 15 patients without kyphosis (Level 0–1), (age:81.3 ± 4.1) ( $P<0.01$ ). Incidences of skin overlap in the umbilical region, moist, filthy umbilical regions in patients with kyphosis, i.e., 65.7%, 60% and 37.1%, respectively, are higher than those without, i.e., 0%, 0%, and 0%, respectively. In 35 patients with kyphosis, nail and/or foot trichophytosis was observed in 18 cases (51.4%), which is not significantly higher than 15 cases without kyphosis (60%).

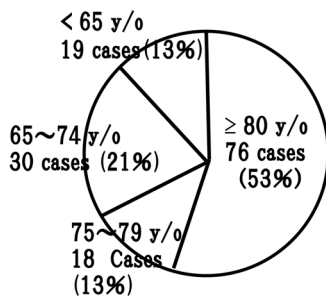
Incidences of skin overlap in the umbilical region, moist, and filthy umbilical regions in patients with kyphosis (Level 2–4) were higher, i.e., 65.7%, 60%, and 37.1%, respectively, than those without it (Level 0–1), i.e., 0%, 0%, and 0%, respectively. In 35 patients with kyphosis (Level 2–4), nail and/or foot trichophytosis was observed in 18 cases (51.4%). This incidence is not significantly higher than 15 cases without severe kyphosis (Level 0–1) (60%). Skin overlap occurred in 5 of 11 cases (45.5%) in patients with moderate kyphosis and, 18 of 24 cases (75%) with severe kyphosis (Level 3–4). Filthy umbilical region occurred in 3 of 11 cases (27.3%) in patients with moderate kyphosis (Level 2) and, 10 of 24 cases (41.7%) with severe kyphosis (Level 3–4). However, no significant difference was observed between the two groups. In 35 patients with moderate–severe kyphosis (Level 2–4), only 3 patients (8.6%) had diabetes mellitus and, 4 (11.4%) had poor nutritional status. These patients

showed the mean BMI was of 22.4 ± 3.5. Four cases (11.4%) were obese with  $\geq 25$  BMI, and same number of patients (11.4%) had lean body stature with  $< 18.5$  BMI.

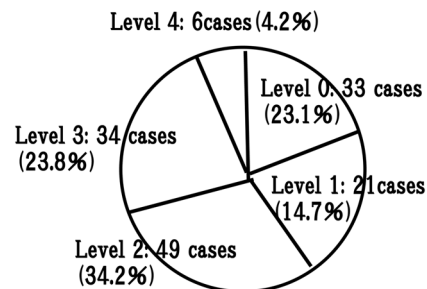
Relationship between age distribution of patients and existence of kyphosis was compared (Figure 3-1). A total of 76 patients aged  $\geq 80$  years old were 76 (53%) and only 19 aged  $< 65$  years old (13%). Visual kyphosis levels in the spinal column showed the number of patients in each Levels (0.1.2.3.4) were 33 (23.1%), 21 (14.7%), 49 (34.2%), 34 (23.8%), and 6 (4.2%), respectively (Figure 3-2). The number of patients without kyphosis, with moderate kyphosis (Level 2), and with severe kyphosis (Level 3–4) was 54 (34%), 49 (34%), and 40 (28%), respectively. Kyphosis levels were higher in elderly people as shown in Figures 3-3, 4, and 5.

3-1 : age distribution (N=143)

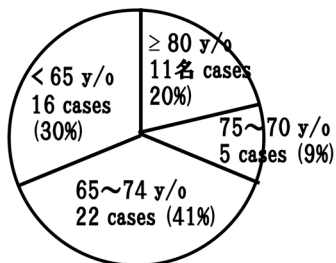
Mean of age (N=143): 76.8±12.3



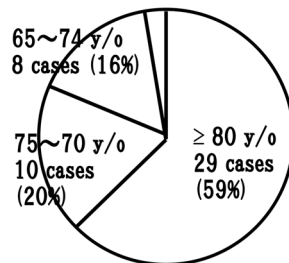
3-2 : kyphosis (N=143)



3-3 : kyphosis (Level: 0-1) (N=54)



3-4 : (Level: 2) (N=49)



3-5 : (Level: 3-4) (N=40)

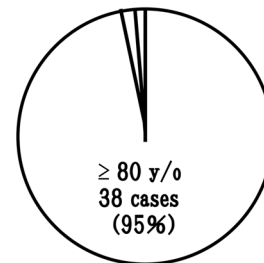


Figure 3 Relationship between age distribution of patients and existence of kyphosis.

As the number of patients who visited the clinic was 143 during the 1-year study period (from April 2018 to March 2019). Relationship between age distribution of patients and existence of kyphosis was compared (Figure 3-1). Patients aged <65 years were only 19 (13%). Patients aged ≥80 years were 76 (53%). Visual kyphosis levels in the spinal column showed number of patients in each Level (0.1.2.3.4) were 33 (23.1%), 21 (14.7%), 49 (34.2%), 34 (23.8%), and 6 (4.2%), respectively (Figure 3-2). The number of patients without kyphosis and with kyphosis without forward-bent posture, with moderate kyphosis (Level 2), and with severe kyphosis (Level 3-4) were 54 (34%), 49 (34%), and 40 (28%), respectively. Kyphosis levels were higher in elderly people (Figure 3-3, 4, and 5).

Discussion

Aging population is increasing internationally, particularly in many countries, such as Japan, Korea, and China. The growth of aging population in Japan is going the fastest in the worldwide<sup>8)</sup>. Japan's experiences about severe aging society should provide for the helpful measures for other countries. Kumakogen town is located in the Southwest region of Shikoku Mountains in Shikoku Island, Japan. In this area, depopulation is rapidly progressing, and aging is most advanced with ≥47% of population aged ≥65 years. This area had the highest aging rate in Ehime Prefecture, which had the 8th aging rate (30.6%) in Japan in 2015<sup>4)</sup>. Kumakogen town can be considered as an advanced district with an aging society. Therefore, many people had kyphosis, especially in the rural district and/or farming area<sup>5)</sup>.

Several risk factors for trichophytosis, and nail and/or foot trichophytosis were reported to be high in places with high average temperature, male, elderly people, family history, vascular diseases, diabetes mellitus, obesity, hyper-

cholesterolemia, wound, bone and joint diseases, sports, liver diseases, kidney diseases, acquired immunodeficiency syndrome, malignant diseases, use of immunosuppressant, steroids, and anti-cancer drugs, etc<sup>9, 10)</sup>. The risk factor of umbilical trichophytosis has not been reported yet, because this is a rare disease entity. Moreover, severe kyphosis would be included as a risk factor of elderly people. Trichophytosis is well known, especially in elderly people even in developed and developing countries. However, trichophytosis corporis rarely occurs, accounting for only 0.68% of all trichophytosis<sup>2)</sup>. However, our survey on the incidence of umbilical trichophytosis is 1.4%/year, which should be very high. Severe kyphosis (Level 3-4), which induces skin overlap as shown in Figure 2, can be considered as one of the causes of high of incidence of umbilical trichophytosis. Skin overlap should induce moist and filthy conditions in the umbilical region, which promotes the occurrence of infection and growth of trichophyton according to our hypothesis. Prophylaxis of infection and inhibition of trichophytosis growth become difficult due to severe kyphosis. In the

present study, localization of umbilical trichophytosis lesion in 3 of 4 cases, should be considered as a special feature. This characteristic finding, localization of umbilical lesion, would occur due to senile kyphosis.

Other main factors that induce the occurrence of filthy umbilical region are insufficient washing/cleaning of the umbilical region. This usually occurs due to skin overlap induced by severe kyphosis with forward-bent posture. Further, kyphosis itself would prevent washing/cleansing of the umbilical region. As the skin overlap was exacerbated due to severe kyphosis, washing the umbilical region becomes more difficult, because it requires the patient to bend forward to wash the umbilical region. The existence of old people providing care for old people is present Japan, and care at home by non-professional persons (husbands or son) (Table 1).

This study had several limitations, i.e., small number of patients, and different methods used to diagnose trichophytosis and kyphosis. Umbilical trichophytosis was diagnosed based on clinical features including skin lesions only. Although the detection rate of trichophyton is very low, no direct evidence, such as direct microscopic examination of clinical samples, histopathology, culture, and serology, was performed in clinics with few facilities. As regards the senile kyphosis levels, the visual classification of kyphosis method was used, because of its convenience and without the need of trained examiners using specialized equipments such as X-rays. The kyphosis levels are no kyphosis, very

slight kyphosis without forward-bent posture, moderate kyphosis with forward-bent posture (approximately 10–40° of lumbar spine), severe kyphosis with forward-bent posture ( $\geq$ approximately 45° of lumbar spine), and very severe kyphosis with forward-bent posture ( $\geq$ approximately 90° of lumbar spine) (Figure 1). Our method is one of the visual classifications for kyphosis in Kurabuchi's study conducted in 2019<sup>7)</sup>. However, our method was independent of Kurabuchi's study. The estimation of kyphosis levels should be more detailed in severe kyphosis in this study, because we included many patients with severe kyphosis.

In conclusion, severe kyphosis with forward-bent posture could be one of the risk factors of umbilical trichophytosis in elderly people. Therefore, the umbilical region of patients with severe senile kyphosis should be more carefully washed by a professional person.

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