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We hope that making available the relevant information on Pachyonychia Congenita will be a means of furthering research to find effective therapies and a cure for PC.
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1. Unna, P. G.: Histopathology of the Diseases of the Skin, translated by
2. Thost: Ichthyosis congenitalis palmare et plantaris, Dissert., Heidelberg,
1880; quoted by Macleod and Unna.
4. Brauer, A.: Uber eine besondere Form des hereditären Keratomes (Kera-
toma dissimpatum hereditarium palmare et plantare), Arch. f. Dermat. u. Syph. 114:
211, 1913.
5. Buschke and Fischer, in Neisser, A., and Jacobi, E.: Iconographia der-
matologica, Berlin, Urban & Schwarzenberg, 1910, vol. 5, p. 183; quoted by
Michael.
including Fuhs,¹ Brunn,² Rinsema,³ Sweitzer,⁴ Galloway,¹¹ Balzer,¹² Neuber,¹³ Lieberthal¹¹ and Sklarz.¹⁸ Its clinical differentiation from the diffuse form is generally easy, for in this type the lesions are not diffuse but invariably disseminate, punctate or papular, appearing several years after birth, usually after puberty. Furthermore, its mode of inheritance cannot be demonstrated in a number of instances. On the other hand, in the diffuse form the disease appears in several consecutive generations. The absence of inflammatory reaction differentiates both types of the condition from acquired hyperkeratosis resulting from local irritation or from the elimination of arsenic.

It is, however, with the diffuse form of the anomaly, keratoma palmar et plantare hereditarium, that I am concerned in this communication, for in the cases reported here the condition belongs to that category. But before the cases are presented certain aspects of the condition which are of general interest will be discussed.

ETIOLOGY

It is generally agreed that the anomaly is a congenital symmetrical diffuse thickening of the horny layer of the palms and soles occurring in several generations. Jacob and Fulton¹⁰ reported 7 cases in three generations and traced the condition in five consecutive generations. An interesting account of the origin of the disease was given by the oldest patient, J. W.: the other 6 patients were his children and grandchildren.

¹⁰ Sweitzer, S. E.: Keratoma Punctatum, Arch Dermat. & Syph. 8:687-694 (Nov.) 1923.
SYPHILIOLOGY

Galloway,11 Balzer,12 al differentiation from ype the lesions are not papular, appearing sev- eral recently, its mode of r instance. On the cars in several consecu- tive reactions, differentiate keratosis resulting from ic. the anomaly, keratoma verified in this communica- tion belongs to that certain aspects of the discussed.

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CHUNG—KERATOMA PALMARE ET PLANTARE

His [J. W.'s] great grandmother, while returning on a troopship from India, was one day looking over the bulwarks and startled by the unexpected jumping of a large fish out of the water. "A fish! a fish!" she cried and clapped her hands together. The child of which she was then pregnant was born with "fish scales" on its hands and feet, as were also the eleven other children to whom she subsequently gave birth. J. W. remembers his grandmother very well and vouches for the fact that both she and his mother suffered from this affection.

Winkle is cited elsewhere as having traced 149 members in five generations of a family with the condition; I have not been able, however, to examine his original paper. Michael 9 reported a case which led him to trace the anomaly in six generations composed of 68 persons above the age of 15; but he was dealing with the pure disseminated type which appears many years after birth. Siemens,17 Brunnauer 18 and others have demonstrated that the condition is a "paradigm of dominant inheritance." There are a few cases on record, however, as pointed out by Leven,19 in which recessive mendelism is apparent. Michael 9 suggested that this indicates the possibility, as has been shown by Siemens 17 for other dermatoses, that one phenotype may represent two or more genotypes. He also suggested that some of the nonfamilial cases may represent the original mutant, for he believed that the mutation which gives rise to the anomaly is still appearing in the race now and then.

HISTOPATHOLOGY

Microscopic examination of sections from the affected areas usually reveals hypertrophy of the stratum corneum or hyperkeratosis. According to Macleod 20 there is no definite change in the prickle cell layer, although occasionally there is flattening of the papillary body. The granular layer appears normal. "The corium is not affected except beyond the margin of the horny thickening or in connection with the fissesures where it may present mild inflammatory changes." The sweat glands are not involved.


DIAGNOSIS

The facts that the lesions are confined to the palms and soles, that they are symmetrical, that they are noticeable at birth or soon thereafter and that they are not associated with marked inflammatory symptoms make it easy to arrive at the diagnosis. The hereditary nature of the disease, manifesting itself as a dominant mendelian character, is also striking.

TREATMENT AND PROGNOSIS

The condition is singularly resistant to treatment. There is no known remedy that gives permanent relief. Pilocarpine, roentgen radiation and certain glandular extracts have been tried, but at best the improvement has been temporary. All that one can hope to do is to reduce the thickening of the skin by means of suitable local treatment with an ointment containing salicylic acid or a similar preparation and thus to render it more flexible and plant. The thickening, however, recurs whenever the treatment is discontinued.

The condition persists throughout life in spite of treatment.

REPORT OF CASES

I. THE WANG FAMILY.—First Case Observed.—The patient (No. 23, generation IV, fig. 1) was a Chinese Christian pastor, concurrently a high school teacher, aged 42. He first came under my observation in the medical clinic on Sept. 1, 1934, because of frequent spells of palpitation of the heart associated with insomnia and dizziness but without shortness of breath or edema. It was found at that time that the symptoms were the result of mental strain and that they had nothing to do with the lesions of his palms and soles, which attracted my attention at once, as I had never seen anything like it before. The patient, however, gave illuminating information, declaring that the condition was a hereditary disease occurring in many members of his family in five consecutive generations. He further stated that the lesions appeared soon after birth, involving not only the palms but also the soles, assuming a bluish erythematous tint before the thickening of the epidermis became noticeable. He said that by the third month the palms and the soles were definitely rougher and thicker than normal. This led me to investigate the mode of inheritance of the condition in the patient’s family.

Lesions of the Palms and Soles: The lesions consisted of diffuse, hard, dry thickening of the horny layer of the epidermis of the palms and the soles, which was symmetrical in distribution and affected the hands and the feet to an equal extent. In the case of the hands, the thickening occupied the entire palms (fig. 2) and the flexor surfaces of the fingers and thumbs. It stopped abruptly at the laterodorsal border of the hands and feet and was surrounded by a pinkish or bluish halo from 2 to 4 mm. in breadth. It spread, however, to the distal two thirds of the dorsa of the fingers, especially around the phalangeal joints, although in those parts it was of much less marked degree (fig. 3). The thickness of the hornified layer of the palms and the soles was from three to five times normal. The surface of the lesion was not quite smooth, and in some places it was distinctly uneven or rough. The normal lines or markings of the palms, fingers, thumbs, soles and toes were obliterated or dis-
SYPHILITIC

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torted. The palms and soles presented a yellowish color with a peculiar semi-
translucent or waxy appearance and a rubbery or horny consistency. In fact, the
palms looked like a pair of thick yellowish rubber or horny plates. Cracks and
fissures were present along the central lines of the palms and also on the
plantar surface of the feet. Occasionally the patient noticed tenderness along
the cracks and fissures, obviously due to inoculation with prothetic organisms.
Oozing and weeping were absent. The nails of the fingers and toes were normal.
Hyperhidrosis was absent, but the patient stated that now and then he noticed
sweating of his palms which rendered the lesion moist and sodden. This usually

![Genealogical tree](image)

\begin{itemize}
  \item \textcolor{red}{\textbf{K}} = Persons with keratoma according to the family report
  \item \textcolor{blue}{\textbf{K}} = Persons with keratoma examined by me
  \item \textcolor{green}{\textbf{K}} = Persons with keratoma examined by other physicians
  \item \textcolor{brown}{\textbf{K}} = Keratoma palmar et plantarum hereditarium
\end{itemize}

Fig. 1.—Genealogical tree showing the transmission of the trait K (keratoma)
in the Wang family.

happened in summer; during the winter the lesions became dry and rough, and
and cracks and exfoliation occurred. The sensibility of the affected skin was impaired
to some extent for heat and pain, and the sense of touch was slightly reduced.
The patient's mother had told him that the lesions of his palms and soles were
noticeable soon after birth. He maintained that the lesions caused no
inconvenience except slight inflammatory reactions which occasionally developed
along the cracks and fissures. He experienced no clumsiness or awkwardness
in using chop-sticks or Chinese pens. In fact, he claimed to be well versed in
Chinese writing, and his penmanship was definitely good. This might he explained
by the fact that he had started using Chinese pens and chop-sticks of necessity in his early childhood. The only thing that bothered him considerably was that when he shook hands with a new friend or with a stranger, the latter invariably withdrew his hand immediately, as if he had touched a monster's hand. This caused him a great deal of social embarrassment. For this reason he always put on a pair of gloves before shaking hands with others. In the hope of getting rid of the lesions he had consulted many physicians and dermatologists, but none of them could help him. Occasionally he obtained some improvement from local application of an ointment containing salicylic acid or some other medicament, but the relief was temporary. He finally learned a cheap method of treatment, that is, to peel off the redundant thick horny layers of the palms and soles very thin and keep them always covered with a thick layer of alcohol or other such substance.

Other (though not shown) pictures (fig. 1) introduce the Wang family. The father had all had some of the condition, both he and his children had the condition on their hands and feet. The son and the daughter (No. 25) had the condition also, but not so severe. In order to remove the thickening of the lesions, he used to soak his feet in hot water. Frazier, physician in charge of the Wang family, tried to improve the condition with various medications, but without success.

Fig. 2.—Palms of J. W., the first patient in the Wang family.

Fig. 3.—Dorsal view of the hands of J. W.
d chop-sticks of necessity in him considerably was that tranger, the latter invariably rea a monster's hand. This For this reason he always

the soles with a sharp knife or razor. The photograph shown in figure 2 was taken shortly after the patient had removed the excessive horny layers of the skin with a knife. But even then the skin was unusually thick.

Other Cases in the Family.—In this family the condition had been traced through six generations. The patient's great grandmother (No. 2, generation I, fig. 1) introduced it into the family, for his great grandfather and previous ancestors all had normal palms and soles. I actually examined only 6 persons—the patient himself, his wife and their 4 surviving children. Two of the daughters (Nos. 24 and 25, generation V, fig. 1), aged 2 and 4 years, respectively, had the same condition of the palms and soles as their father. The lesions of these children, like those of all other persons in the previous generations, were congenital. The palms and soles showed a purplish pink color after birth and considerable

![Fig. 4.—Lateral view of feet of one daughter (No. 24, generation V) of the Wang family.](image)

thickening of the horny layers. By the third or fourth month after birth the lesions became prominent, and they persisted throughout life. Figure 4 shows the feet of one of the daughters (No. 25). The lesions of this girl were exactly like those of her father, except that considerable cracking and exfoliation of the horny layers of the affected areas were present. The lesions in the other daughter (No. 24) showed no appreciable difference from those already referred to; hence photographs of them are omitted.

In order to obtain an accurate diagnosis, I referred the father to Dr. C. N. Fraizer, professor of dermatology and syphilology. He immediately made the diagnosis of hereditary keratoma of the palms and soles and made valuable suggestions for the further investigation.

II. THE YANG FAMILY.—Soon after I observed the condition in the Wang family, my attention was drawn to the fact that a member of the clerical staff...
of the hospital came from a family known to have the same anomaly. At first I wondered if this family was related to the Wang family. It was my good fortune to be able to examine most of the members of this large family. The traditional old-fashioned Chinese family system has many drawbacks, but in this instance it rendered the genealogical investigation easy, for members of three generations were living together in a big compound, although in different courtyards.

The youngest patient was a 13 year old boy and the oldest person living who had the condition was a woman (No. 4, generation IV, fig. 5) aged 71, whose family name was Ho. She will be referred to as patient I of this family. She declared positively that her great grandfather (No. 1, generation I, fig. 5), her grandfather (No. 3, generation II, fig. 5), two of her three great-uncles (Nos. 2 and 5, generation II, fig. 5) and her father (No. 4, generation III,

Fig. 5.—Genealogical tree showing the transmission of the trait K (keratoma) in the Yang family. Personal data concerning members of family are as follows:

IV. 4, female aged 71, case 1 in the Yang family
IV 9, male aged 45
V 11, female aged 44
V 14, male aged 42
V 17, male aged 40
V 19, male aged 37
V 20, male aged 33
VI 5, female aged 25
VI 9, male aged 21
VI 10, female aged 18
VI 16, male aged 18
VI 21, male aged 12
VI 22, female aged 16
VI 23, female aged 14
VI 24, female died at 8
VI 25, female aged 15
VI 26, female aged 18
VI 27, female aged 15
VI 28, female aged 16
VI 29, female aged 16
VI 30, female aged 15
VI 31, male aged 12
VI 32, female aged 13
VI 33, male aged 14
VI 34, male aged 11
VI 35, female aged 13
VI 36, female aged 8
VI 37, female aged 7
VI 38, female aged 5
VI 39, male aged 3
VI 40, male aged 16

Fig. 5) all had had exactly the same condition of the skin as she, for she had lived with them and known them well. Her husband (No. 3, generation IV, fig. 5) and his family never had the disease, and her marriage introduced the condition into the Yang family and spread it to other families when her affected female descendants were married. Like the patient in the Wang family, she also knew that the condition of her palms and soles was hereditary. She took pride in showing me, in the most courteous and friendly manner, her palms and soles and those of her progeny. (Figures 6 and 7 show lesions typical of those seen in this family.) She stated that in all the cases in the family, the condition was congenital and persisted throughout life.

At birth the palms and soles of affected offspring already had a slightly darker color than normal, and by the end of the third month the skin of the palms and soles was definitely thickened and rough. The condition first involved the finger-tips, the thenar and the hypothenar eminences, the soles, the anterior third of the plantar surface and the ventral aspect of the toes. Gradually the lesion spread diffusely over the entire palms and soles, its border being well demarcated. During so much description the condition of the skin was.
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1 the oldest person living situation IV. fig. 5) aged 71, as patient I of this family. o. 1. generation I. fig. 5), of her three great-nieces or (No. 4. generation III, of the trait K (keratoma) members of family are as

ged 16 VI. 39. female aged 15
ged 17 VI. 31. male aged 15
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ged 15 VI. 34. male aged 15
ged 16 VI. 35. female aged 2
ged 18 VI. 36. female aged 2
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ring already had a slightly third month the skin of the The condition first involved onces, the soles, the anterior of the toes. Gradually the soles, its border being well
demarcated by a pale bluish line. Cracks and fissures were, however, absent during early infancy. On the whole the lesions observed in this family were so much like those already described for the Wang family that any further description is superfluous. It must be added, however, that in this family the condition was somewhat more pronounced or accentuated, so that perception of heat and pain was impaired to such an extent that the patients had to use the
dorsa of their hands to perceive pain and heat. In fact, members of the family declared that their hands were better than those of other persons, in that they could pick up a piece of glowing charcoal or the red-hot glass chimney of a kerosene lamp between their fingers and thumbs without being burned. The sensation of touch was not much impaired. In a few of the affected children who did not keep their hands clean the lesions of the palms gave a dirty dark brown warty appearance.
As seen in figure 5, there were 19 surviving patients in the family during the period of investigation. I examined 15 of them myself, while the other 5 were examined by other physicians. The statement that 5 deceased members had suffered from the same condition was made by the old woman patient (patient 1). Her statement was probably correct, because in the cases of all the other 19 members of the family examined either by me or by other physicians, she had made the right diagnosis. Similarly, all the persons she declared normal were found to be so.

**SOCIAL AND MENTAL STATUS OF THE FAMILIES INVESTIGATED**

The Wang Family.—This family had lived in Hokienfu, Hopei Province, China, for several hundred years at least. Mr. Wang (No. 23, generation IV, fig. 1) came to Peiping in 1921 and had since settled down in that city. His great-grandparents came from the highest possible social caste of their day in Hokienfu, his great-grandfather being a Chinese scholar ("Chia Jen") and his great-grandmother the daughter of a noted general in the Ching dynasty. Although the offspring of this couple never attained equal social prominence, on the whole they could have passed easily as members of the middle class, most of them being merchants and farmers.

There was no known history of mental or nervous disease in the last few generations of the family. The genealogical data obtained from the patient were reliable, as he was intelligent and was in charge of the "Chu Pu," or family record book, for some time. All his statements as to the presence or absence of the condition in his wife and children were subsequently confirmed by my personal examination. Hence there was no reason to doubt his statements concerning the distribution of the condition among the other members whom he had seen and lived with for years.

The Yang Family.—This family had been in Peiping for more than two hundred years. The original members probably came from one of the suburbs of the city. Although none of the members of the family in the last generation had attained any extraordinary social distinction, the family stood rather high in the middle class. In fact, the family had produced scholars ("Hsiu Ts'ai"), physicians and government officers. Most of the surviving members belonged to what may be called the student class. One of the members (no. 15, generation V, fig. 5) had had symptoms of syringomyelia for the last twelve years, in addition to the condition of the palms and soles. This combination, however, was probably accidental.

**ANALYSIS OF THE GENEALOGICAL CHARTS**

With the aid of the legends, the genealogical charts are more or less self-explanatory. When a person with the trait K (keratoma palmare et plantare hereditarium) marries a normal partner, half the children, theoretical free from children when the often (affected who had for the 1 to 25 not figures a
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AL CHARTS

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THEORETICALLY, should carry the condition, while the other half should be
free from it. In other words, the ratio between normal and abnormal
children should be 1 to 1. This result can be observed, however, only
when the couple produces numerous children. This does not happen
often. One can, however, add up the number of affected and non-
affected children in different generations descended from an ancestor
who had the condition and obtain a ratio of approximately 1 to 1. Thus
for the Wang family and the Yang family, the ratios are 24 affected
to 25 normal and 28 affected to 30 normal persons, respectively. These
figures are obtained as shown in the tabulation.

<table>
<thead>
<tr>
<th>Generations</th>
<th>Yang Family</th>
<th>Wang Family</th>
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<td>Ratio Between Affected and Nonaffected Persons</td>
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<td>II</td>
<td>3 : 1</td>
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<td>III</td>
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<td>IV</td>
<td>2 : 0</td>
<td>9 : 10</td>
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<tr>
<td>V</td>
<td>5 : 6</td>
<td>8 : 12</td>
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<td>VI</td>
<td>12 : 11</td>
<td>14 : 11</td>
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<tr>
<td>Total</td>
<td>24 : 25</td>
<td>28 : 30</td>
</tr>
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From the genealogical charts the following inferences can be drawn:

1. The trait K does not skip a generation but may not occur in the
   first few children, suddenly appearing in succession in later offspring,
   or it may follow the reverse course or appear in every other child.

2. The trait K appears in a relatively large number of members of
   the same family.

3. Only the persons who show the trait K transmit the disease.
   Normal offspring of an affected parent never transmit the condition.

4. For each generation the number of affected offspring of a parent
   tends to be about the same as the number of normal offspring, provided
   that the number of children is large.

The analysis shows that K is a single dominant trait.

SUMMARY

Keratoma palmare et plantare hereditarium occurring in two Chinese
families is reported. Three patients were observed in one family and
19 in the other (14 patients were examined by me and 5 were examined
by other physicians). The condition has been traced through six gen-
erations in one family and through seven in the other.

A description of the lesions of the affected areas, palms and soles, is
given. The definition, etiology, histopathologic picture, treatment and
prognosis of the condition are discussed briefly.

The genealogical trees of the two families, showing the mode of
inheritance of the disease, are presented.

Analysis of the genealogical tree leads to the conclusion that K is
a single dominant trait in the families investigated.