

New Notations for Better Morphological Distinction of Postaxial Polydactyly of the Foot

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Background: There have been many reports on the classification and treatment of postaxial polydactyly of the foot. However, despite its being a common congenital anomaly, there is no universal notation about its morphology.

Methods: We performed an analysis of 65 postaxial polydactyly cases from 2004 to 2021. Judgment criteria for deciding the surgical procedure were selected, and the points required for notation were decided. Based on them, we devised a new notation.

Results: The necessary points required for notation were decided based on the following criteria: (1) the presence and level of syndactyly, (2) bifurcation level of the phalanges, (3) the presence of other deformities, and (4) predominant toes. We came up with a new notation and description method. Different types of syndactyly were represented using a horizontal bar, and predominant toes were represented using equality or inequality symbols. The bifurcation level of the phalanges and accessory deformities were additionally recorded (eg, 4—5>—6, Middle, 5,6: External rotation). From this notation, it is obvious which toe should be resected. Furthermore, syndactyly, accessory deformities, and the condition of the phalanges are also easily understood.

Conclusions: Our new notation for postaxial polydactyly consists of some related symbols that are each provided a meaning. This system is simple, especially for easily understanding the morphology, and ideal for daily medical use. We conclude that it could become a universal notation method for cases of postaxial polydactyly of the foot. (*Plast Reconstr Surg Glob Open* 2022;10:e4504; doi: [10.1097/GOX.0000000000004504](https://doi.org/10.1097/GOX.0000000000004504); Published online 3 November 2022.)

INTRODUCTION

Polydactyly is one of the most common congenital anomalies of the limb.¹ Polydactyly of the foot is classified as preaxial, central, or postaxial depending on the location of the duplication.² Postaxial polydactyly of the foot accounts for approximately 80% of all cases.^{2–4} Various classifications of postaxial polydactyly have been reported.^{2,4–8} However, the morphology of polydactyly cannot be understood just by looking at those classifications, and the

surgical method is not associated with them. For daily medical use, a useful notation that is simple is very important, especially for understanding the morphology. Our team devised a new universal notation for postaxial polydactyly of the foot. This study aimed to describe the new notation and to show the usefulness of it.

METHODS

We performed a retrospective analysis of patients with postaxial polydactyly who underwent polydactyly surgery at our institution from January 2004 to March 2021. There were 54 patients (65 feet), with 19 males (25 feet) and 35 females (40 feet). All cases were reclassified using existing classifications. These classification methods were compared and analyzed according to their differences and similarities, as well as their advantages and disadvantages. Judgment criteria for deciding the surgical procedure were selected, and the points required for notation were

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decided. Our team devised a new notation, and the following is a description of our method.

NOTATION

First, the polydactyly side is confirmed, and “R” (for Right) or “L” (for Left) is written. The presence and level of syndactyly are evaluated using a horizontal bar(—). Complete syndactyly is symbolized by an upper bar(⌒), incomplete syndactyly is symbolized by a middle bar(—), and no syndactyly is symbolized by an under bar(⏟). The predominant toes are then determined from the size and morphology of the toes and nails in macroscopic findings, and the size of the phalanges and the alignment of the joints from X-ray findings. The superiority or inferiority of the toes is represented using equality (=) or inequality symbols (<, >). These symbols are placed between the numbers 4, 5, and 6. The bifurcation level of the phalanges is evaluated by X-ray findings. The level is classified in the following five stages: distal phalange, middle phalange, proximal phalange, metatarsal, and floating.⁶ The level is written after the numbers. In the case of a hypoplastic phalange, we predict and describe the approximate branch level and put a “not formed” note. Finally, the presence or absence of other deformities is evaluated. When there are deformities, such as shortening, plantar or dorsal

Takeaways

Question: This study is aimed to describe a new universal notation for postaxial polydactyly of the foot. For daily medical use, a useful notation that is simple is very important, especially for understanding the morphology.

Findings: Our team devised a new notation and description method. Different types of syndactyly were represented using a horizontal bar and predominant toes were represented using equality or inequality symbols. The bifurcation level of the phalanges and accessory deformities were additionally recorded (eg, 4-5>6, Middle, 5,6: External rotation).

Meaning: This system is simple, especially for easily understanding the morphology, and ideal for daily medical use.

internal rotation, and external rotation, they are listed as an accessory deformity (Fig. 1).⁶

RESULTS

All of these cases are surgery cases. There were seven (10.8%) unclassifiable cases in X-ray findings because some

Nakamura's classification		IIB	IIA	IC	IB	IA, ID
Macroscopic findings	Scheme					
	Notation	4 [—] 5 [—] 6	4—5 [—] 6	4_5 [—] 6	4_5—6	4_5_6
X-ray findings	Scheme					
	Notation	Distal phalange	Middle phalange	Proximal phalange	Metatarsal	Floating
Accessory deformity	Scheme					
	Notation	6:Shortening	6:Internal rotation of the plantar	6:Internal rotation of the dorsal	6:External rotation	

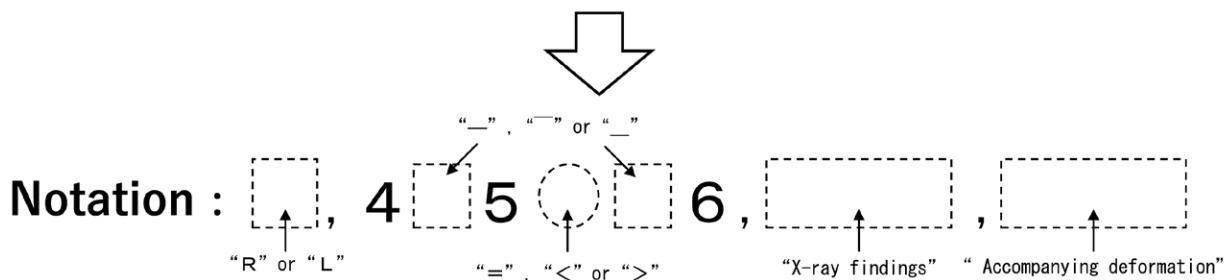


Fig. 1. New notation for postaxial polydactyly of the foot and its description. The upper row shows macroscopic findings (with Nakamura classification added), the second row shows X-ray findings, and the third row shows accompanying findings. The scheme and notations are shown, respectively. The final polydactyly notation is created by combining all the notations from these findings.



Fig. 2. A case of polydactyly of the foot in a 9-month-old boy. In this case, there is polydactyly without syndactyly of the right foot. The fifth and sixth toes are similar size, and the metatarsal bone is bifurcated. The fifth toe shows internal rotation of the plantar and the sixth toe shows external rotation. Therefore, this is notated as “R, 4_5=_6, Metatarsal, 5: Internal rotation of the plantar, 6: External rotation.”

bones were not yet formed. From this notation, it is obvious which toe will be resected. Furthermore, syndactyly, accessory deformities, and the condition of the phalanges are also easily understood. Therefore, it is possible to determine the necessary surgical method just by looking at this notation.

CASE

A 9-month-old boy had right polydactyly on the foot (Fig. 2). The morphology was described as “R, 4>_5=_6, Metatarsal, 5: Internal rotation of the plantar, 6: External rotation” using our notation. From this notation, the following surgical methods were expected. There is no syndactyly, the fifth and sixth toes are equivalent, and the metatarsal bone is bifurcated. The sixth toe will be resected from the metatarsal bone and transfer of the abductor digiti minimus muscle will also be required. The surgery performed on this case was a success and good results were obtained (Fig. 3). (see figure, **Supplemental Digital Content 1**, which displays notations and surgical method of another case: a 9-month-old girl with polydactyly of the foot, <http://links.lww.com/PRSGO/C149>.)

DISCUSSION

Generally, a notation is a system of symbols, characters, and abbreviated expressions.⁹ Therefore, the meaning of a notation should be obvious at the first glance and it should be common. Common notations on medical records are also useful in the medical field, and important information necessary for medical treatment can be obtained from the notations.

There are many classifications for polydactyly of the hand and foot.^{2,4-8,10} However, the morphology of polydactyly cannot be easily understood just by looking at the notation of those classifications, such as “type I,” “type II,” “type A,” etc. In addition, some classifications often use the same notation for completely different morphology types. Therefore, we felt the need for a new notation that is more useful in daily medical care. Such a notation is easily understood at a glance and the necessary surgical method can be imagined just by looking at it.

We assess the superiority and inferiority of the toes based on both macroscopic and X-ray findings and

consider the postoperative morphology. From the 65 cases we analyzed, the necessary points required for notation were decided based on the following criteria: (1) the presence or absence and level of syndactyly, (2) bifurcation level of the phalanges, (3) the presence of other deformities, and (4) predominant toes based on the size of phalanges, the axis of the joints, and the shape and size of the nails. Evaluation of hypoplastic phalange is also important. Based on the above items, our team devised this new notation. For the bifurcation level of the phalanges



Fig. 3. Results 3 years after the operation. Internal rotation of the plantar is well corrected by the transfer of the abductor digiti minimus.

and accessory deformities, Nakamura's classification was modified.⁶

In this report, only postaxial polydactyly of the foot is notated. However, this notation can be developed, and it can potentially be applicable to preaxial and central polydactyly of the foot and polydactyly of the hand. We believe this notation can become a revolutionary and universal notation method for any case of polydactyly of the limbs.

CONCLUSIONS

We described a new notation method for postaxial polydactyly of the foot. This notation is simple, especially for understanding morphology. We believe this notation can become a widely useful method because it uses symbols that anyone can easily understand.

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