The PNB Classification for Treatment of Fingertip Injuries

The Boundary Between Conservative Treatment and Surgical Treatment

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Abstract: The PNB classification, which was advocated by Evans and Bernadis, separates the injuries into their effects on 3 components of the fingertip: pulp, nail, and bone. Because each component is subdivided into 7 or 8 items, this can describe fingertip injuries more precisely. Between 1997 and 2003, we treated 381 fingertip injuries (279 males, 102 females; average age, 41.2 years) in our facilities. A 3-digit number was provided for each of the 381 cases in accordance with the PNB classification. We extracted patients in whom amputated tissues did not exist, and predicted the boundary between conservative treatment and surgical treatment by individually comparing the curative results of the same type of injuries. In conclusion, PNB 355–366 and PNB 455–466 were most suitable for surgical treatment, and the boundaries between surgical treatment and conservative treatment were PNB 386 and 666 and 700. The results, which are the criteria for surgical treatment, are summarized as follows; 1) More than two thirds of the distal phalanx remains. 2) The nail bed defect ranges from one third to half. If the defect is more or less than the criteria, the surgical treatment is less significant. Recognition of the boundary and prevention from unnecessary surgical treatment leads to minimum invasive surgery for fingertip injuries.

Key Words: fingertip injury, PNB classification, conservative treatment, surgical treatment

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There have been a few attempts to classify fingertip injuries, such as Allen classification[1] and Ishikawa classification[2] (distal digital amputation levels). Although these classifications are very simple and easy to apply, they cannot describe the details of an injury. The PNB classification,[3] which was advocated by Evans and Bernadis, separates the injuries into their effects on 3 components of the fingertip: pulp, nail, and bone (Table 1). Because each component is subdivided into 7 or 8 items, this can describe fingertip injuries more precisely. Therefore, we think it possible to systematize treatment of fingertip injuries by the use of the PNB classification. In this study, we examined the boundary between conservative treatment and surgical treatment when amputated tissues did not exist.

SUBJECTS AND METHODS

Between 1997 and 2003, we treated 381 fingertip injuries at our facilities. Two hundred seventy-nine patients were male, and 102 patients were female. The ages ranged from 0 to 88 years (average, 41.2 years). Our treatment methods were as follows: microsurgical replantation, 52; composite graft (including Brent's method), 103; stump plasty, 57; skin flaps, 36; skin graft, 8; and conservative treatment, 125 (Fig. 1). The types of skin flaps used were as follows: thenar flap, 15; cross-finger flap, 5; V-Y advancement flap, 5; reverse digital island flap, 5; volar advancement flap, 3; and others, 3. Several clinicians performed treatment based on their own judgment, considering the patient's social background. Therefore, therapeutic strategies slightly differed among the same type of injuries.

A 3-digit number was provided for each of the 381 cases in accordance with the PNB classification. Considering items P1 and 2 as well as items N1 to 4, the groups excessively vary. Therefore, in this study, these items (items P1 and 2, items N1–4) were omitted, and injuries were assigned to items to which the state was considered most approximate. Subsequently, we extracted patients in whom amputated tissues did not exist (226 patients: conservative

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TABLE 1. The PNB Classification for Fingertip Injuries

Pulp	Nail	Bone
0: No injury	0: No injury	0: No injury
1: Laceration	1: Sterile matrix laceration	1: Tuft
2: Crush	2: Germinal + sterile matrix laceration	2: Comminuted nonarticular
3: Loss–distal transverse	3: Crush	3: Articular
4: Loss–palmar oblique partial	4: Proximal nail bed dislocation	4: Displaced basal
5: Loss–dorsal oblique	5: Loss–distal third	5: Tip exposure
6: Loss–lateral	6: Loss–distal two thirds	6: Loss–distal half
7: Loss–complete	7: Loss–lateral	7: Loss–subtotal
	8: Loss–complete	8: Loss–complete

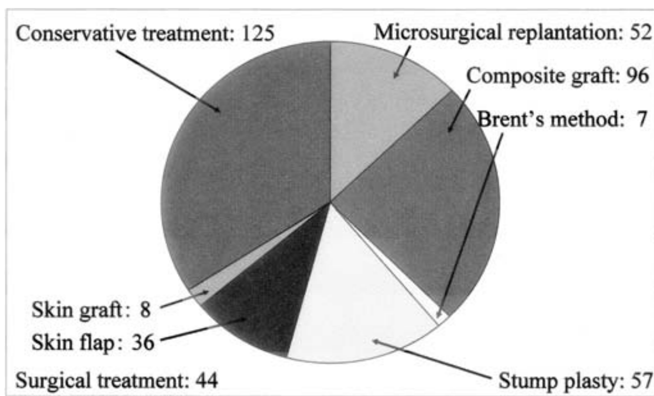

FIGURE 1. Subjects: 381 fingertip injuries.

treatment, 125; surgical treatment (skin flaps and graft), 44; stump plasty, 57) and collected the data on therapeutic strategies with respect to items P3 to 7. We collected the data on therapeutic strategies with respect to the PNB classification. In particular, we predicted the boundary between conservative treatment and surgical treatment by individually comparing the results of treatment between patients who underwent conservative treatment and those who underwent surgical treatment (skin flaps and skin graft) among patients with the same type of injuries. To evaluate the results, we made much of final appearance but took several factors into consideration such as postoperative scar and contracture at the donor site, and total curative period, including rehabilitation, admission/outpatient, and medical financial issue.

RESULTS

The results of data collection on therapeutic strategies with respect to the PNB classification in patients in whom amputated tissues did not exist are shown in Figure 2. We investigated the boundary between conservative treatment and surgical treatment with respect to items P3 to 7, and the results are shown subsequently.

Pulp 3 and 7: Horizontal Amputation

Amputation at a site distal to PNB 355 could be treated by conservative treatment without any problem, and surgical treatment should not be performed at this level (Fig. 3). PNB 355–366 could be treated by conservative treatment, but the cosmetic outcomes were often not satisfactory. At this level, surgical treatment was considered more appropriate to achieve reconstruction of a better fingertip morphology and

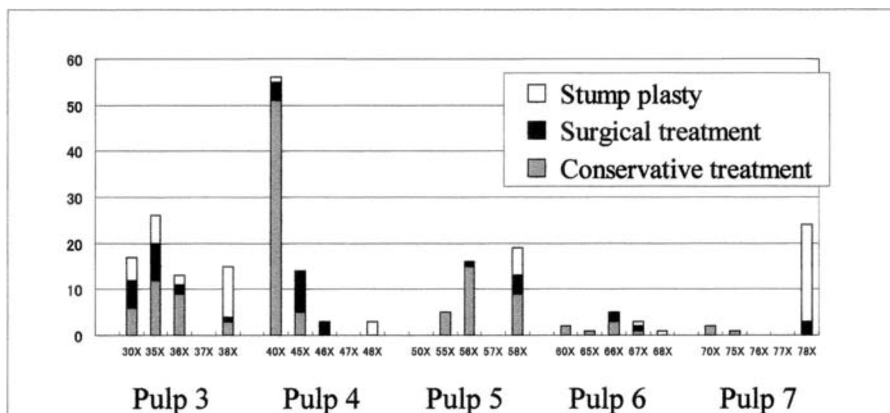

FIGURE 2. Methods: Conservative versus surgical treatment with respect to the PNB classification in patients in whom amputated tissues did not exist.

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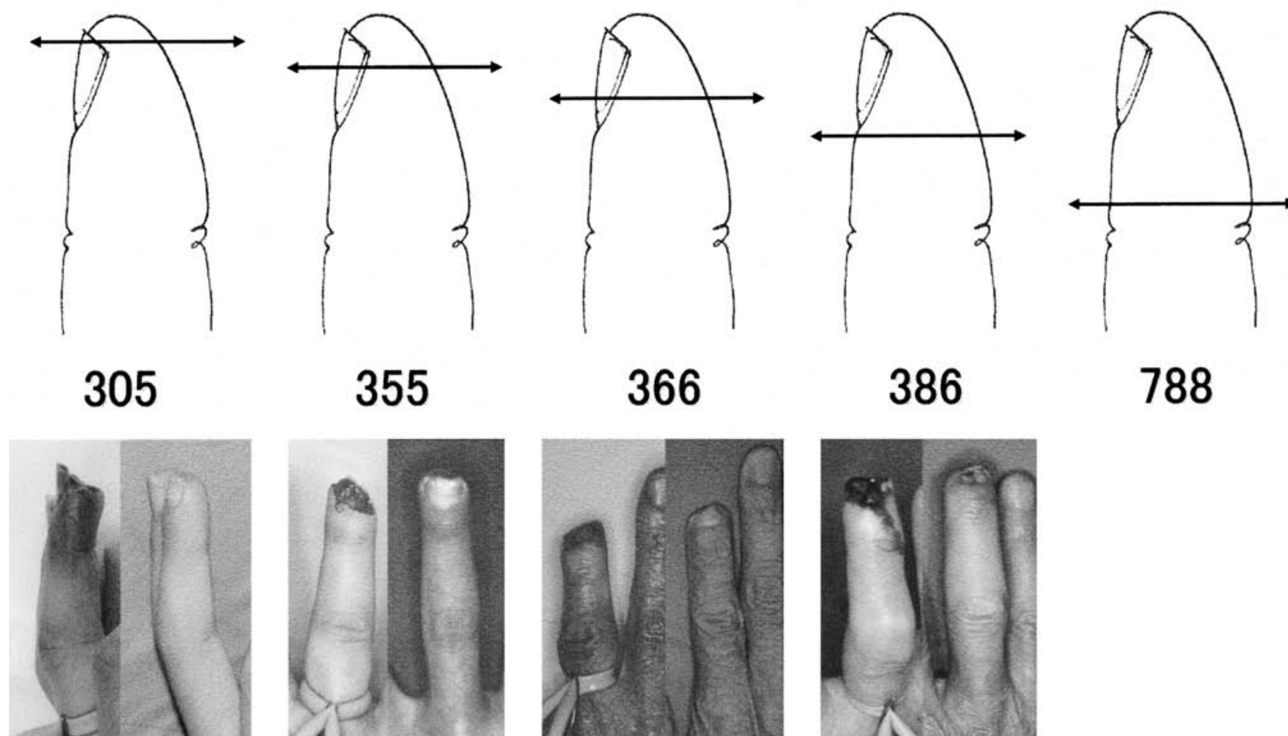

FIGURE 3. Pulp 3 and 7: horizontal amputation. Presented cases were treated by conservative treatment. The boundary between conservative treatment and surgical treatment was considered PNB 386. PNB 355–366 seemed suitable for surgical treatment.

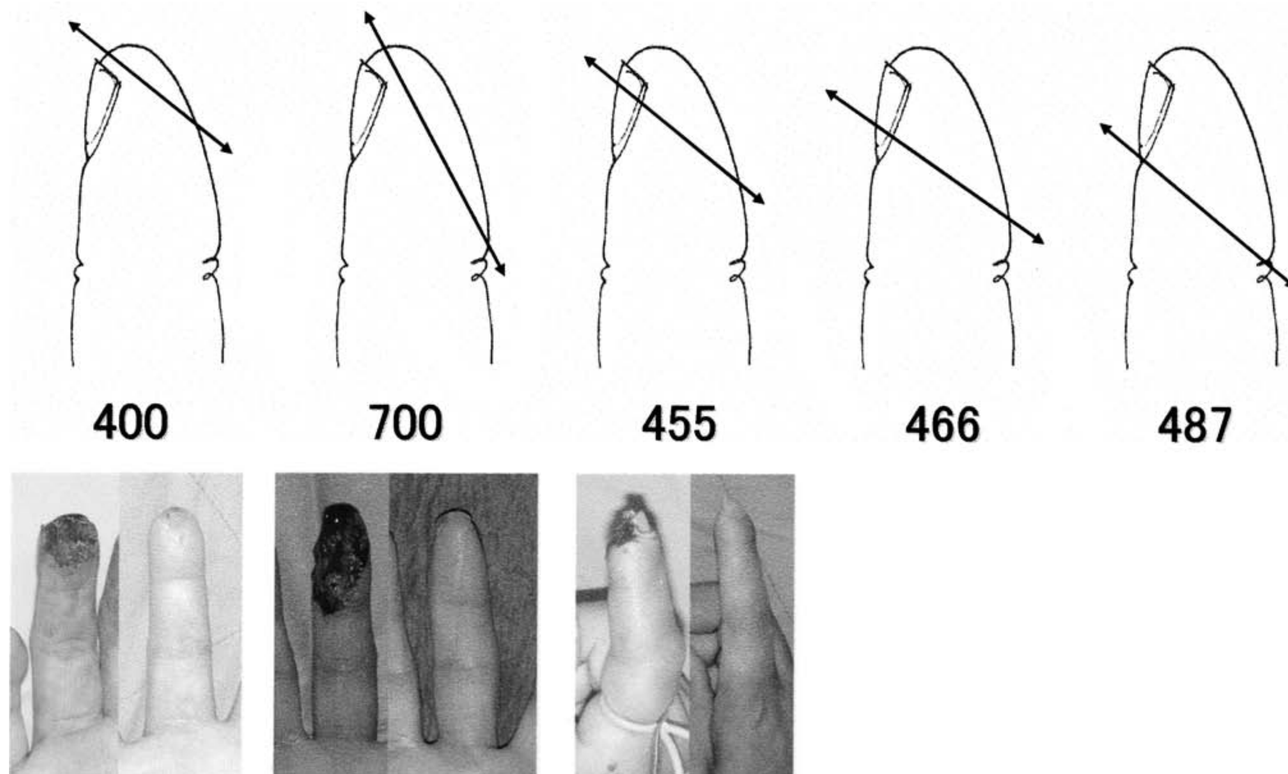

FIGURE 4. Pulp 4: palmar oblique amputation. Presented cases were treated by conservative treatment. The boundary between conservative treatment and surgical treatment was considered PNB 700. PNB 455–466 seemed suitable for surgical treatment.

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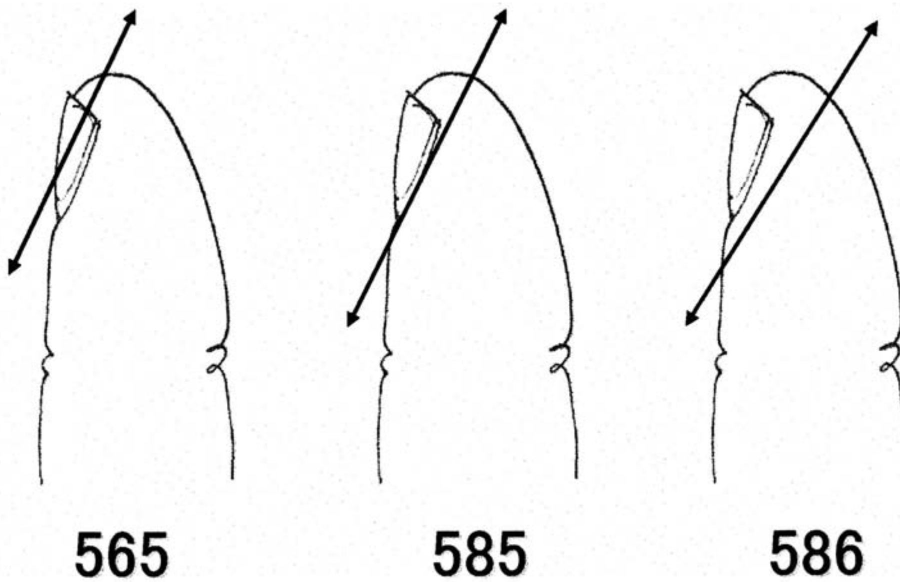

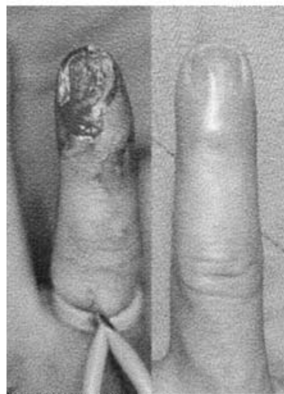

FIGURE 5. Pulp 5: dorsal oblique amputation. The presented case was treated by conservative treatment. Conservative treatment was considered appropriate for pulp.

early closure of the wound; however, small flaps such as V-Y advancement flap, volar advancement flap, and thenar flap should be used with respect to the postoperative scar. PNB 366–386 could be treated by both treatments. The boundary between conservative treatment and surgical treatment was considered PNB 386. When the tissue defect involved the entire distal phalanx as demonstrated in PNB 787–788, there were no procedures other than stump plasty.

Pulp 4: Palmar Oblique Amputation

PNB 400, in which the injury does not involve the nail bed, could be treated by conservative treatment (Fig. 4). PNB 700, in which nail/bone defects are less marked despite complete defect of the finger pulp, could be treated by conservative treatment; however, conservative treatment was successful only when residual soft tissues were present to some degree without exposure of the distal phalanx. When the soft tissue defect is marked, surgical treatment (skin flaps or skin graft) may be indicated. PNB 455–466, as well as PNB 355–366, were most appropriate for surgical treatment with a skin flap. In the PNB 455 state, although conservative treatment was generally recommended for children, cosmetic/functional outcomes were not satisfactory in some children.

Pulp 5: Dorsal Oblique Amputation

PNB 565, in which nail bed/bone defects are less marked, could be treated by conservative treatment (Fig. 5). When the nail defect is more marked as demonstrated in PNB 585–586, surgical treatment may not achieve any cosmetically satisfactory result as a result of the absence of residual nail. Overall, conservative treatment was considered appropriate for pulp 5.

Pulp 6: Lateral Oblique Amputation

When the nail bed and the greater portion of nail matrix existed as demonstrated in PNB 655–665, this state could be treated by conservative treatment (Fig. 6). When the nail defect

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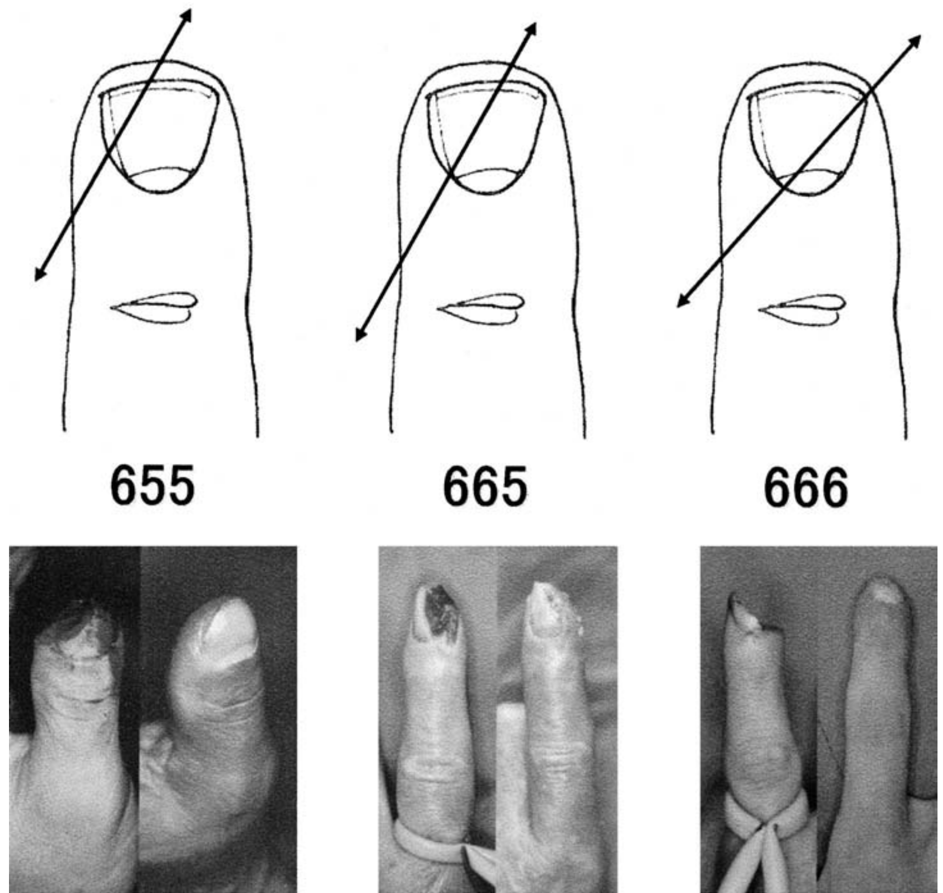

FIGURE 6. Pulp 6: lateral oblique amputation. Presented cases were treated by conservative treatment. The boundary between conservative treatment and surgical treatment was considered PNB 666.

involves a more extensive area, as demonstrated in PNB 666, surgical treatment with a skin flap should be indicated.

DISCUSSION

If amputated tissues exist, microsurgical replantation or composite graft should be attempted. If not, in the case of a whole distal phalanx defect such as in PNB 788, stump plasty must be chosen. In other cases, conservative treatment or surgical treatment (skin flaps and skin graft) must be used at the discretion of the hand surgeon.

Surgical treatment does not always achieve functional outcomes with respect to the postoperative scar at the donor site and postoperative resting (fixation), and in many cases it requires admission, raising a medical financial issue. Conservative treatment requires a longer interval until epithelialization than surgical treatment; however, it does not readily induce joint contracture and does not require admission. A therapeutic strategy for fingertip injury should be selected considering the advantages and limitations of each procedure. However, surgical treatment is easily performed in clinical practice, and complex surgical treatment tends to be praised in several journals.

The first purpose of this study was to systematize treatment of fingertip injury; however, our study was significant for admonishing against easygoing surgical treatment and recognizing the efficacy of conservative treatment again. Furthermore, the results of this study may be applied not only to fresh fingertip injuries, but also to necrosis of the microvascular replantation site or composite graft.

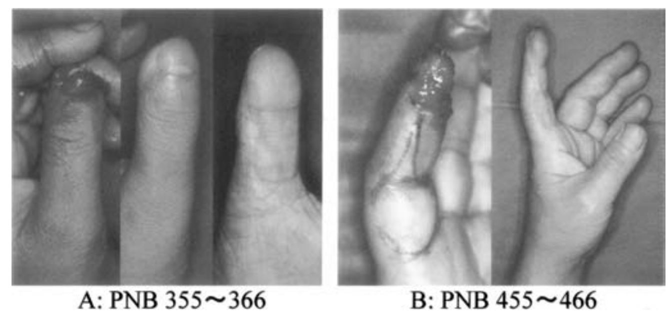

FIGURE 7. Most suitable types for surgical treatment. (A) PNB 355–366. A 32-year-old woman with PNB 355 fingertip injury was treated by the volar advancement flap. (B) PNB 455–466. A 51-year-old woman with PNB 466 fingertip injury was treated by the reverse digital artery island flap.

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CONCLUSION

PNB 355–366 and PNB 455–466 were most suitable for surgical treatment (Fig. 7), and the boundaries between surgical treatment and conservative treatment were PNB 386 and 666 and 700. The results, which are the criteria for surgical treatment, are summarized as follows: 1) More than two thirds of the distal phalanx remained. 2) The nail bed defect ranges from one third to half. If the defect is more or less than the criteria, the surgical treatment is less significant. Recognition of the boundary and prevention from unnecessary surgical treatment leads to minimum invasive surgery for fingertip injuries.

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