



Usefulness of Irradiated Polyglactin 910 (Vicryl Rapide) for Skin Suturing during Surgery for Lateral Ray Polydactyly of the Toes in Children

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Background: This study describes the use of a bioabsorbable suture for skin suturing during surgery for lateral ray polydactyly followed by favorable postoperative outcome without the need for postoperative suture removal.

Methods: A 5-0 Vicryl Rapide suture was used for skin suturing during surgery for lateral ray polydactyly in 9 children (mean age, 12.4 mo). Children were allowed to walk and bathe 2 weeks after surgery when over-the-suture taping therapy was started.

Results: In all cases, the Vicryl Rapide suture disappeared completely within 3 weeks of surgery, and no removal of residual suture was required. No postoperative complications, such as suture abscess, wound dehiscence, or ulcer, were observed. During a mean 24-month postoperative follow-up, no elevation of the interdigital space due to hypertrophic scarring or scar contracture was observed, and no revision surgery was required.

Conclusions: Although the breaking strength of Vicryl Rapide declines within the first 10 days after surgery, this property will unlikely lead to postoperative wound dehiscence due to a relatively light load being applied to the lateral toes. The use of a bioabsorbable suture for skin suturing during surgery for lateral ray polydactyly is highly beneficial as it eliminates pain caused by suture removal and the risk of tissue damage while reducing the burden on medical staff. (*Plast Reconstr Surg Glob Open* 2013;1:e42; doi: 10.1097/GOX.0b013e3182a85b13; Published online 23 September 2013)

The unaesthetic appearance of feet due to congenital deformity is an intolerable burden among Japanese people who spend a considerable time without footwear indoors. Lateral ray polydactyly is one of the most common congenital anomalies of the toes of children encountered in

daily clinical practice and is usually treated surgically by removing vestigial toes and constructing interdigital spaces during the patient's childhood.¹ To avoid disadvantages of surgery for lateral ray polydactyly in children, such as scarring at the skin donor site, scar contracture, and pigmentation after skin grafting, we previously reported a new surgical procedure using a bell-bottom flap, where removal of a vestigial toe and construction of a sufficient interdigital space can be performed simultaneously without skin grafting.² This surgical procedure has significantly reduced postoperative stress in children by avoiding the formation of a persistent scar in the inguinal region or other skin donor sites and by eliminating the need to use a Kirschner wire for joint immobilization. One of

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DOI: 10.1097/GOX.0b013e3182a85b13

Disclosure: The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.

the unresolved problems with this procedure is pain inevitably experienced by children during postoperative suture removal. During postoperative suture removal after surgery for congenital anomalies of toes in children, the child's body motion must be strongly constrained to ensure proper holding of the suture, which causes significant stress to both the child and the medical staff. Therefore, to eliminate the need for postoperative suture removal, we used a Vicryl Rapide bioabsorbable suture (Ethicon, Somerville, NJ) during surgery for lateral ray polydactyly. Vicryl Rapide is produced by irradiating Vicryl (Ethicon), a braided suture made from a copolymer of glycolic acid and lactic acid named Polyglactin 910, for accelerated bioabsorption.³ This suture is rehydrolyzed into glycolic acid and lactic acid in the body in 7–10 days after surgery. It retains 50% of its breaking strength at 5 days and almost none at 14 days, and eventually the whole suture disappears.⁴ Vicryl Rapide, despite being a braided suture, passes through the tissue smoothly with a low coefficient of friction and causes a minimal inflammatory reaction.⁵ The suture is also suitable for use in children because of its soft feel on the skin.⁵ Although Vicryl Rapide is routinely used for skin suturing during surgery for congenital anomalies of fingers and toes in children, no previous study has assessed in detail the intraoperative and postoperative appearance of toes and postoperative management after surgery using this type of suture. This report describes our experience with Vicryl Rapide for skin suturing during surgery for lateral ray polydactyly followed by favorable postoperative outcomes without the need for postoperative suture removal, including the descriptions of its procedure and postoperative management.

OPERATIVE PROCEDURE

Lateral ray polydactyly is divided into 2 types—fifth ray duplication and sixth ray duplication—according to the classification based on x-ray findings proposed by Watanabe et al.⁶ We performed the following surgical procedure with a case series of fifth ray duplication classified accordingly. Therefore, the fifth toe with an irregular bone shape was always removed as a vestigial toe.

In cases of lateral ray polydactyly with a fused fourth interdigital space, the previously reported procedure using a bell-bottom flap was applied.² Skin incision lines of the bell-bottom flap surgical technique were prepared as shown in Figure 1. Flap A was used for the reconstruction of the interdigital space, flaps B and D for the reconstruction of the sidewall

of the fourth toe, and flap C for the reconstruction of the sidewall of the sixth toe. The length between 2 points in each line was determined according to the following rules: 1) line bd was extended outward from line bc to ensure its length matched that of line ab; 2) point l was placed at the same level as that of the web of the fourth interdigital space, and curved line lf was designed to be the same length as that of line dc plus line ce; 3) line lk was designed to be 10–20% longer than the interdigital distance; 4) line jk was designed to be as long as line bc; 5) line fg was designed to be as long as line gi; and 6) line dh was designed to be as long as line hi (Fig. 1).

In cases without fusion in the fourth interdigital space, a dorsal zigzag line was designed for the removal and suturing of the fifth toe, as described in case 1 below (Fig. 2A). This line was designed with the following points in mind: 1) the suture wound should not extend to the fourth interdigital space to prevent scar contracture in the interdigital space; 2) a small triangular flap must be created at the nail base to prevent deformation of the nail wall of the medial side of the sixth toe; and 3) a small triangular flap must be created at the tip of the sixth toe to prevent heart-shape deformation of the tip of the sixth toe (Fig. 2A).

In both surgical procedures, incision, fifth toe removal, and wound closure were made along the pre-marked lines after tourniquet inflation. Skin suturing was completed without subcutaneous suturing, and only 5-0 Vicryl Rapide was used in all cases. All suture knots were tied with 4 square knots. No skin grafting was required in any of the cases undergoing the present surgical procedure. After suturing, the surgical wound was protected by an ointment gauze dressing. The treated limb was immobilized with a bandage and further protected with a cast. When this was done, bulky dressing was applied by placing gauze in all interdigital spaces. The wound was examined and disinfected every 3 days for 2 weeks after surgery with 0.02% benzalkonium chloride. Scabs attached to the wound were treated carefully to avoid damage to the tissue around the wound as a result of forcible scab removal. The cast was removed and the patient was allowed to bathe 2 weeks after surgery. The patient was instructed to gently clean the wound with foamed soap during bathing. The patient's mother was instructed to apply 1 layer of Micropore skin tone surgical tape (3M, Tokyo, Japan) around the treated toes over the suture after each bathing. For patients whose interdigital spaces were constructed using a bell-bottom flap, an additional tape was applied longitudinally to the interdigital space. Taping therapy with the skin tone tape was continued for 6 months after surgery.

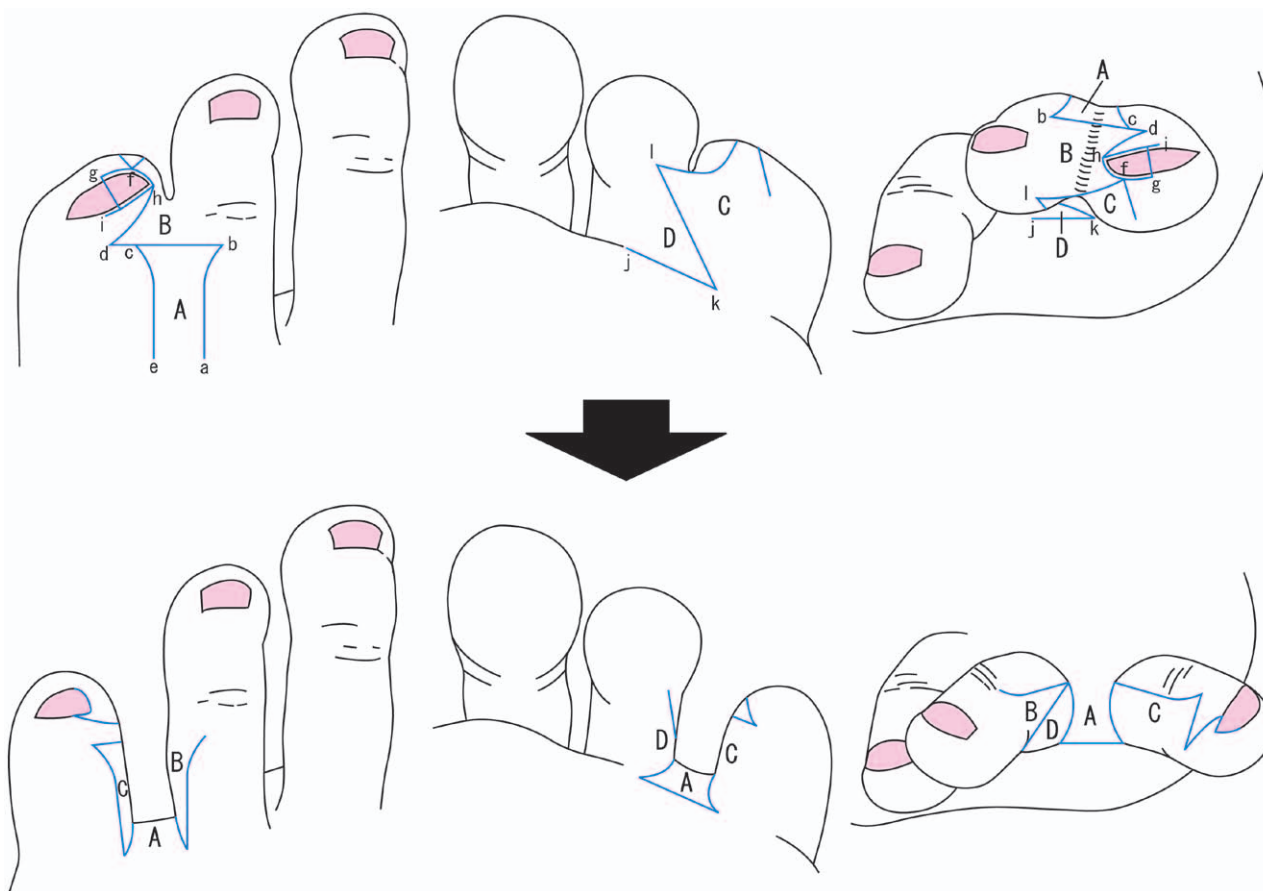


Fig. 1. Schema of the surgical technique of “the bell-bottom flap.” Modified from a figure in Matsumine H, Yoshinaga Y, Morioka K, et al. A new surgical technique for lateral ray polydactyly without skin graft: the bell-bottom flap. *Plast Reconstr Surg.* 2010;125:134e–135e. Adaptations are themselves works protected by copyright. So in order to publish this adaptation, authorization must be obtained both from the owner of the copyright in the original work and from the owner of copyright in the translation or adaptation.

CLINICAL CASES

A 5-0 Vicryl Rapide suture was used in skin suturing in 9 children (6 males and 3 females; mean age, 12.4 mo), including 6 children undergoing removal of vestigial toes and construction of interdigital spaces with the bell-bottom flap procedure and 3 children undergoing only removal of vestigial toes with the dorsal zigzag procedure. Patient age ranged from 11 months to 6 years. All operations were performed by the same experienced plastic surgeon. The flaps were confirmed to give a wide and deep interdigital space. Surgery was completed without skin grafting or joint fixation with Kirschner wires in all cases. All children were discharged from hospital the day after surgery. In all cases, the Vicryl Rapide suture used for skin suturing disappeared completely by 3 weeks after surgery, and thus no removal of residual suture was required. No postoperative complications, such as suture abscess, wound dehiscence, or skin ulcer, were observed. During a mean 24-month postoperative follow-up, no elevation of the interdigital space

due to hypertrophic scarring or scar contracture was observed, and thus no revision surgery was required. Cosmetic outcomes were also satisfactory.

Case 1

A 16-month-old girl had right lateral ray polydactyly with no syndactyly of the fourth interdigital space (Fig. 2A). Removal of the fifth toe was planned based on its appearance and x-ray findings, and the sixth toe was constructed using a dorsal zigzag incisional line (Fig. 2B). Bathing and taping therapy were started 2 weeks after surgery (Fig. 2C). All sutures had disappeared by 3 weeks after surgery (Fig. 2D). No early postoperative complications, such as suture abscess and wound dehiscence, were observed. A favorable cosmetic outcome was obtained with no flap pigmentation or scar contracture for 12 months after surgery (Fig. 2E).

Case 2

A 11-month-old boy had right lateral ray polydactyly with the fourth interdigital space showing syn-

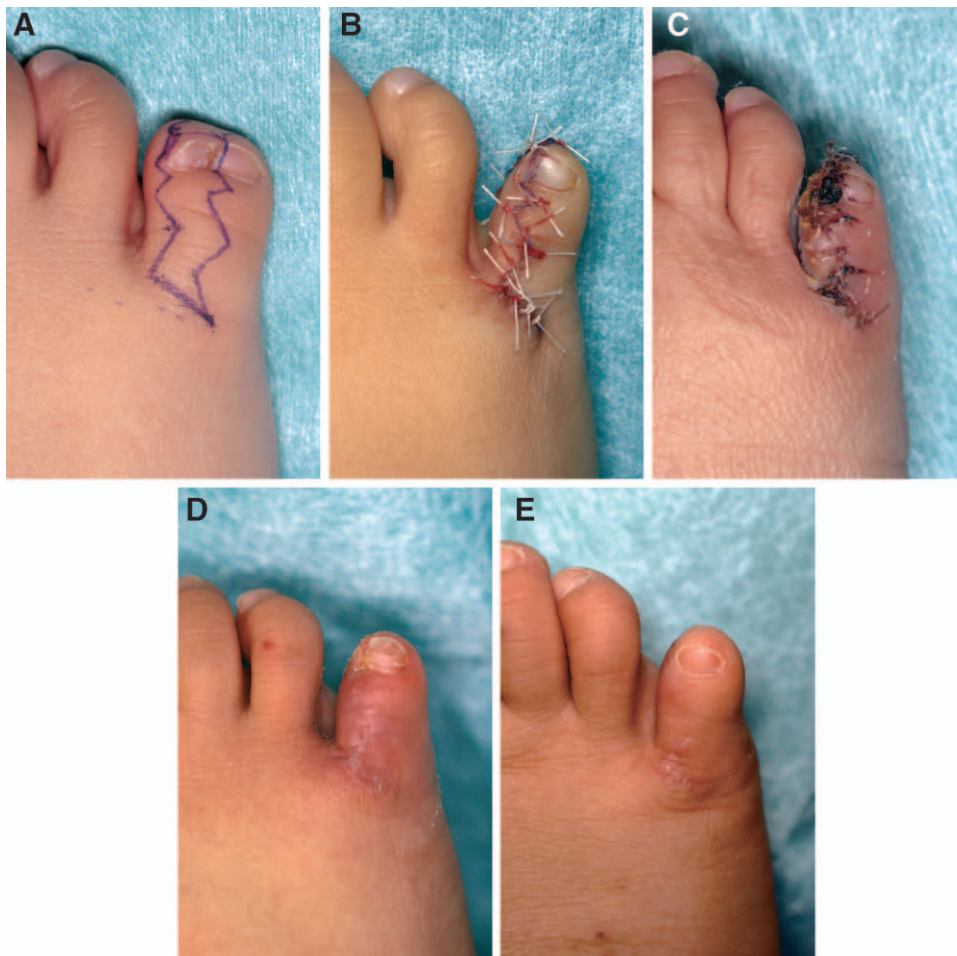


Fig. 2. A, Preoperative design on the dorsal side of the patient in case 1. B, Immediate postoperative view of the sixth toe. Postoperative view of the dorsal side of the treated sixth toe at 2 wk (C), 3 wk (D), and 1 y (E). All sutures had disappeared by 3 wk after surgery. Taping therapy was continued for 6 mo, followed by a favorable cosmetic outcome with no hypertrophic scar formation.

dactly extending to the distal interphalangeal joint (Fig. 3A). Removal of the fifth toe was planned based on its appearance and x-ray findings, and the sixth toe and fourth interdigital space were constructed by the bell-bottom flap surgical technique using Vicryl Rapide (Fig. 3B). Excellent blood flow was achieved in the 4 flaps showing no partial necrosis after surgery. Bathing and taping therapy were started 2 weeks after surgery (Fig. 3C). Similar to case 1, all sutures had disappeared by 3 weeks after surgery (Fig. 3D). No early postoperative complications, such as suture abscess or wound dehiscence, were observed. The patient showed a favorable clinical course with no web formation, hypertrophic scarring, or flap pigmentation for 12 months after the operation (Fig. 3E).

DISCUSSION

The requirements for a good bioabsorbable suture are as follows: 1) maintaining breaking strength until sufficient tissue cure is achieved; 2) getting absorbed by mild inflammatory reaction once suture

support is no longer required; and 3) not inducing infection.³ Skin suturing using a suture not meeting these requirements leads to persistent scar tenderness and suture extrusion.⁷ Tandon et al⁸ used the Vicryl Rapide suture in the suturing of 236 wounds (mostly scalp, abdominal, and scrotal wounds) and observed no suture abscess or other postoperative complications, suggesting that this surgical material adequately meets the above requirements.

Several reports have demonstrated that the use of Vicryl Rapide in suturing of the scalp⁹ and hands^{10,11} of children is highly reliable and avoids suture removal. However, no previous report has provided detailed descriptions of the intraoperative and postoperative appearance of toes after surgery for congenital anomalies of toes in children using Vicryl Rapide probably because surgeons want to avoid the risk of wound tension and subsequent dehiscence caused by weight load during walking. Al-Qattan⁴ used the Vicryl Rapide suture in skin suturing for syndactyly of the hands and observed no wound de-

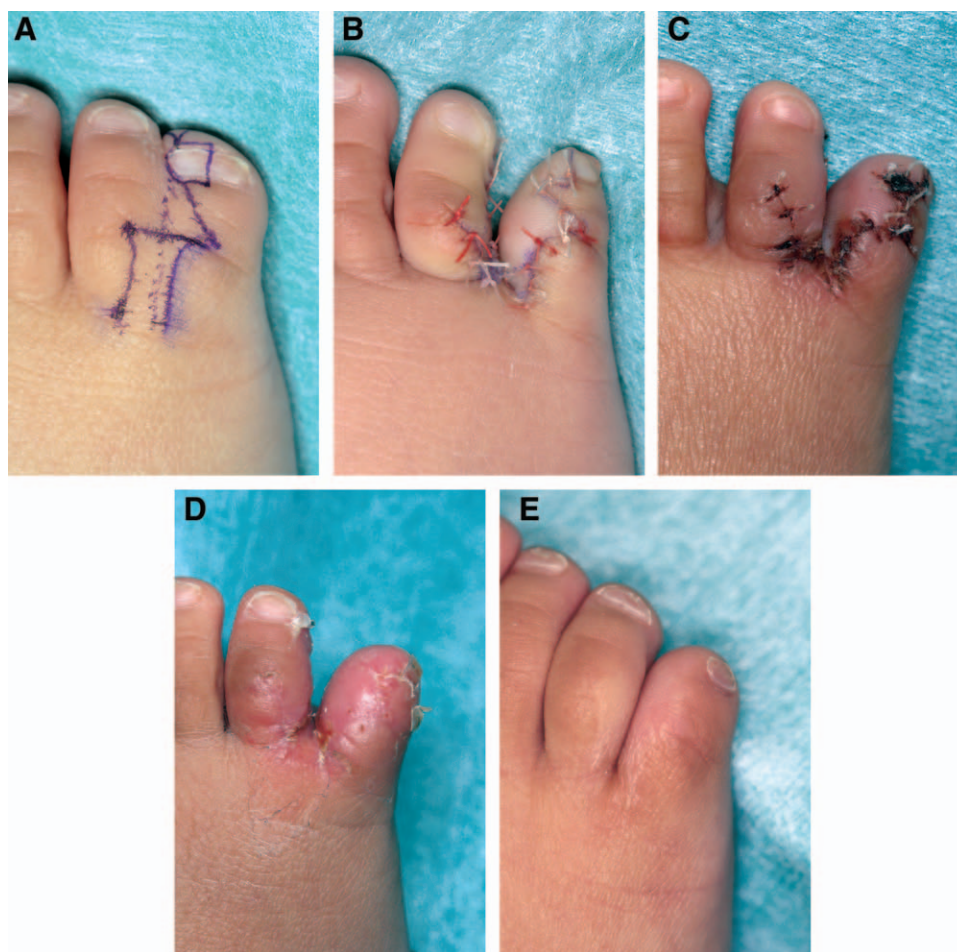


Fig. 3. A, Preoperative design on the dorsal side of the patient in case 2. B, Immediate postoperative view of the interdigital region. C, The 2-wk postoperative view. The cast was removed and the patient was allowed to bathe. D, The 3-wk postoperative view. All sutures had disappeared. E, One-year postoperative view of the dorsal side of the treated interdigital space.

hiscence despite its rapid absorption, suggesting that the breaking strength of the suture maintained only over the first 10 days after surgery is sufficient for surgery for congenital anomalies in children. In the cases reported herein, the use of the Vicryl Rapide suture in skin suturing for lateral ray polydactyly, another congenital anomaly affecting the foot, did not cause wound dehiscence or other complications. There are 2 likely reasons contributing to these favorable outcomes: 1) in the present cases of lateral ray polydactyly, sutures were made in the lateral aspect of the foot not subjected to heavy weight load during walking; and 2) the bell-bottom flap used in the present cases do not require skin grafting and surgery was completed by suturing between well-vascularized tissues, leading to favorable wound healing. In addition, the breaking strength of the suture maintained only over the first 10 days after surgery seemed to be sufficient in the present procedures.

Parell and Becker¹² stated that the rapid degradation of the Vicryl Rapide occurring in 7–10 days is

cosmetically ideal in terms of the interval between wound closure and the disappearance of the bioabsorbable suture. They also found no significant difference between absorbable and nonabsorbable sutures in the long-term cosmetic outcome with respect to postoperative scarring after the suturing of clear wounds in the face and head in adults.¹² Bharathi et al¹³ examined the wound healing process after suturing perineal lacerations with Vicryl Rapide, compared with chromic catgut suturing, and observed a significant reduction in wound indurations, uncomfortable stitches, and wound dehiscence and better wound healing in the Vicryl Rapide group, which they suggested was due to less tissue reaction caused by Vicryl Rapide and its rapid absorption. The reconstruction of esthetically pleasing toes without hypertrophic scarring was also achieved in the present cases probably because the rapid degradation of the Vicryl Rapide suture was suitable for surgery for lateral ray polydactyly. Another wound closure method for pediatric treatment involves using an absorbable suture

material to place deep dermal sutures at key points and apply octyl-2-cyanoacrylate (Dermabond; Ethicon, Somerville, NJ) before closing the wound. This is an excellent suturing method that does not require postoperative suture removal and has been used in the treatment of primary cleft lip repair, for example.¹⁴ However, lateral ray polydactyly that involves detailed and complex design for bone and joints in patients with small toes requires accurate yet durable sutures of tiny skin flaps in a three-dimensional manner to prevent postoperative deformation of toes. If absorbable deep sutures and Dermabond are used in such cases, we believe it would require highly skillful surgical techniques and a longer operation time. Therefore, we recommend superficial epidermal closure with Vicryl Rapide in lateral ray polydactyly to minimize variability in surgical outcomes due to the skill of surgeons and to reduce operation time.

Many other advantages of the use of the Vicryl Rapide suture, such as avoidance of pain associated with suture removal and tissue damage, reduced burden on medical staff, and reduced time required for outpatient examination, also support the usefulness of Vicryl Rapide in skin suturing during surgery for lateral ray polydactyly.

CONCLUSION

This study reported favorable outcomes obtained using Vicryl Rapide for the surgical correction of lateral ray polydactyly of the toes in children.

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