

The Bipedicle Advancement Flap on Skin Coverage After Mucous Cyst Excision:A Retrospective Study of 18 Cases.

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Abstract

Background : Many patients have skin defects after digital mucous cyst (DMC) excision, and this study aimed to assess the clinical outcomes of using a bipedicle advancement flap to cover such defects.

Methods : From January 2016 to January 2018, DMCs on 18 fingers of 15 patients (4 males and 11 females, with a mean age of 64 years) were treated with cyst and osteophyte excision and a bipedicle advancement flap to cover the resultant defect in this retrospective study. Postoperative flap survival, healing and infection were evaluated. The pre- and postoperative ranges of motion (ROMs) of the distal interphalangeal (DIP) or thumb interphalangeal (IP) joints were recorded. Postoperative patients' satisfaction was assessed by the visual analogue scale (VAS; 0-10).

Results : The patients were followed up for 12-36 months (mean, 20 months). All the flaps survived, the incisions healed well without infection, and no cyst recurrence occurred. The postoperative ROM of the affected fingers was restored to the preoperative ROM by two months after surgery. No difference was found between the preoperative and postoperative ROMs. The score of patients' satisfaction for surgery by means of VAS was 8.5 ± 1.0 .

Conclusions : The bipedicle advancement flap is a simple and effective technique for covering skin defects following DMC excision.

Background

A digital mucous cyst (DMC) is a common disease most often caused by degenerative changes in the distal interphalangeal (DIP) or thumb interphalangeal (IP) joints [1-4]. Many patients have skin defects that are too large to be sutured directly, or skin necrosis may occur after surgery due to high tension at the incision after removal of a DMC. Various reconstructive methods have been reported for these skin defects, such as skin grafting and many kinds of flaps (rotation flap, rhomboid flap, digital artery perforator flap, etc.). Skin grafting requires additional procedures and causes donor site morbidity [10], and the function of the grafted skin is often poor. Many authors believe that the risk of skin necrosis is reduced by skin flaps such as a rhomboid flap, digital artery perforator flap and rotation flap, which allow excision of mucous deposits invading the thin skin overlying the cyst. Therefore, many authors advocate skin excision and the use of local flaps to cover the resulting defect [5-9]. Although the function of skin flaps is often more satisfactory than that of skin grafts, most of the designs and procedures for skin flaps are relatively complex. Thus, identifying a simpler and easier method is necessary. The purpose of this retrospective study was to investigate the outcomes of treating DMCs using a bipedicle advancement flap.

Materials And Methods

Approval for this retrospective study was obtained from the institutional review board at of our hospital. We identified patients who were surgically treated for DMCs using a bipedicle advancement flap from

January 2016 to January 2018. The diagnosis was determined based on clinical findings and plain X-rays. The inclusion criteria were patients diagnosed with a DMC presenting as a round or oval, translucent, rubbery nodule covered with thinned skin. The exclusion criteria were septic DIP or thumb IP arthritis, subungual cysts resulting in severe nail deformity, cyst rupture with infection and any comorbidity that may influence the clinical effect of the flap, such as diabetes, rheumatoid arthritis and gout. According to the criteria, a total of fifteen patients (18 fingers), including 4 males and 11 females with a mean age of 64 years (range, 47-77 years), were enrolled in this study. The thumb was involved in 5 patients, the index finger was involved in four patients, the middle finger was involved in five patients, and the ring finger was involved in four patients. All cysts were located slightly distal to the dorsal DIP or thumb IP joint and often on the distal dorsoradial or dorsoulnar aspects of these joints. The cysts ranged in size from 0.5 cm × 1.0 cm to 0.7 cm × 1.2 cm. Preoperative routine X-ray examinations showed different degrees of degenerative changes in the DIP or thumb IP joints, and osteophyte formation at the cyst site was observed in 14 fingers (77.8%). The characteristics of patients were shown in Table 1. The preoperative range of motion (ROM) of the DIP or thumb IP joints was recorded. All cysts were removed, and a bipedicle advancement flap was designed to cover the defects (Figure 1).

Surgical technique

Surgery was performed under a digital nerve block using 2% lidocaine solution. A digital tourniquet was applied. The location of the skin incision depended on the position of the cyst. A transverse spindle-shaped incision was made around the thin skin on the surface of the cyst, and the length of the incision exceeded that of the cyst (Figure 1A). Because the skin on the surface of the cyst was very thin and could not be dissected, this skin was excised with the cyst. After the cyst was completely resected, a longitudinal incision was made in the joint capsule using the preoperative X-ray findings and palpation to locate the position of the osteophyte, and the osteophyte was completely removed with a rongeur. The extent of osteophyctomy did not exceed the edge of the normal articular cartilage. The joint capsule was sutured tightly. Then, the tourniquet was removed to observe blood circulation, and any skin without blood circulation was resected completely, leaving a spindle-shaped skin defect. At the proximal side of the defect, a new incision with a similar length and arc to the proximal edge of the incisional defect was made (Figure 1B). The distance between the two incisions was at least half the length of the proximal edge of the incisional defect ($a:b \geq 1:2$). The new incision extended along the surface of the extensor tendon. The tissue was separated from the surface of the tendon, and then an advancement flap with two pedicles was created. The flap was pulled to the distal end to allow the defect to be sutured with little to no tension. The proximal edge of the new incision was also separated along the proximal side of the surface of the tendon and pulled to the distal side, and then the new incision was sutured. Finally, the defect was covered with the bipedicle advancement flap (Figure 1C). Figure 2-6 show a representative case.

Outcome measures

Postoperative flap survival, incisional healing and infection were evaluated. The ROM of the DIP or thumb IP joints 2 months postoperatively was measured. Postoperative patients' satisfaction was assessed by VAS score at the least times follow-up.

Statistical analysis

A paired t-test was used to compare the pre- and postoperative ROMs of the DIP or thumb IP joints. Statistical significance was accepted for probabilities $< 5\%$ ($P < 0.05$).

Results

All the flaps survived after surgery, and the incisions healed well. No infections occurred. The sutures were removed 2 weeks postoperatively. Postoperative pathological examinations showed that all the tumors were mucous cysts. The patients were followed up for 12-36 months (mean, 20 months), and no cyst recurrence was noted. After systemic physical therapy and functional exercises, the ROM of all the fingers was restored to the preoperative ROM by 2 months after surgery. The DIP/TIPJ ROM of preoperative was 71.7 ± 14.0 (range 42 to 92) points and post-operative 71.8 ± 15.6 (range 35 to 100) points. No difference was found between the preoperative and postoperative ROMs of the DIPJ/TIPJ ($P > 0.05$). The score of patients' satisfaction for surgery by means of VAS was 8.5 ± 1.0 . The summary of the results were shown in table 2.

Discussion

A DMC is a common cyst that is defined as a ganglion involving the DIP joints of the fingers or the IP joints of the thumbs [5,9]. Surgical excision of DIP or IP mucous cysts is necessary when a patient reports discomfort in daily activities, the cyst is causing slight nail deformity, or the surrounding skin becomes fragile and thin, leading to pain and increasing the risk of joint infection [11]. However, many patients have skin defects that are too large to be sutured directly due to high tension at the incision after removal of a DMC, which may result in skin necrosis. Therefore, many kinds of flaps have been designed to overcome this challenge. Jiménez I reported a Zitelli bilobed flap [11] that can sufficiently cover the skin over the DIP joint in a short period. Skin necrosis occurred in one case on the most distal part of the first lobe after surgery, which healed by secondary intention without the appearance of a synovial fistula at the final follow-up. Johnson SM [12] reported a local advancement skin flap and did not observe skin necrosis during the follow-up. Imran D [7] reported a rhomboid flap and observed no skin necrosis. Although these flaps can sufficiently repair skin defects after DMC removal and lead to excellent results, the procedure is challenging in terms of significant donor site morbidity and requires intensive postoperative monitoring, microsurgical skill, appropriate equipment and many operating room resources [13].

The usefulness of bipedicle advancement flaps to cover skin defects has been established, and the use of such flaps has been widely reported in the literature at various anatomic areas, including the scalp,

eyelids, ears, upper forehead, nose, chin, mucosa, lip, neck, trunk and extremities [14]. However, only a few studies have reported using this flap to cover defects after removal of a DMC.

In our research, DMCs were treated with cyst resection, osteophyctomy and a bipedicle advancement flap to cover the defect. All the flaps survived after surgery, and the incisions healed well. No infections occurred, and no cyst recurred during the follow-up. No difference was found between the preoperative and postoperative ROMs of the thumb IP or DIP joints.

Whether removing osteophytes is necessary remains controversial. Although some authors have reported successful treatment of DMCs without osteophyctomy [10,15], many authors have reported that removing osteophytes is an important step for treating DMCs [9,15-17], and these studies showed that osteophyte removal resulted in a low cyst recurrence rate. However, some authors have reported that aggressive osteophyctomy caused a decreased ROM of the DIP joint [18]. In our study, osteophyte formation was found in 14 fingers, and all the osteophytes were removed. We ensured that the excision did not involve the edge of the normal articular cartilage when the osteophytes were removed.

Mucous cysts are subcutaneous but may be covered with thin skin with or without ulceration [19]. After resection of the cyst, the bipedicle advancement flap can be used to cover the postoperative skin defect when the incision cannot be sutured directly due to high tension at the incision. When we made the second incision, we used a similar length and arc to the proximal edge of the incisional defect and maintained a distance between the two incisions of at least half the length of the proximal incisional edge. The new incision extended along the extensor tendon surface, and the flap was separated from the tendon surface. These steps were performed to maintain as much blood circulation as possible to the flap.

The use of a bipedicle flap for skin coverage after DMC excision has the following advantages: (1) The flap is safe due to its dual pedicle blood supply, thus decreasing the risk of flap necrosis or flap failure. (2) Bipedicle flaps allow increased tissue movement by direct advancement. The blood supply artery does not need to be dissected, and the flap pedicle does not need to be twisted when covering the defect. (3) Use of this flap often allows scars to be hidden in the skin lines of the dorsal side of the thumb IP or DIP joint. (4) Donor site morbidity and postoperative monitoring requirements are minimal. As the flaps use local tissue, the surgeon has a greater ability to successfully match the skin color and texture. (5) Importantly, once a bipediced flap fails, other strategies can still be employed to cover the defect [13].

In conclusion, mucous cyst excision together with the overlying skin, removal of osteophytes on the affected side, and coverage with a bipedicle advancement flap provides reliable treatment results with high patient satisfaction and a low recurrence rate based on our experience. Some points should be kept in mind when using this flap. First, as a random flap, the flap length:width ratio should not exceed 2:1 to enable sufficient blood supply. Second, the flap pedicle and the digital extensor tendon should be protected carefully. Third, the excision did not involve the edge of the normal articular cartilage when the osteophytes were removed. Furthermore, the long diameter of the transverse spindle-shaped incision

should be parallel to the skin of dorsal side of the thumb IP or DIP joint, allowing the surgery scar to be easily hidden.

Abbreviations

DMC:Digital mucous cyst;ROMs:Ranges of motion ;DIP: Distal interphalangeal;IP: Interphalangeal;VAS:the visual analogue scale.

Declarations

Ethics approval and consent to participate:It was approved by the Ethics and Academy Committee of the Affiliated Zhongshan Hospital of Dalian University.

Consent for publication:Not applicable.

Availability of data and materials:All datasets used during the current study are available from the corresponding author on reasonable request.

Competing interests:The authors declare that they have no competing interests.

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Authors' contributions: SY designed the study.All surgeries performed by SY, MYM, YZF, SQS and CYQ. MYM completed the draft of the manuscript.MXJ was responsible for date analysis. MYM and SQS also contributed to data collection and outcomes evaluation. All authors read and approved the final manuscript.

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Tables

Please see supplementary files section to access the tables.

Figures

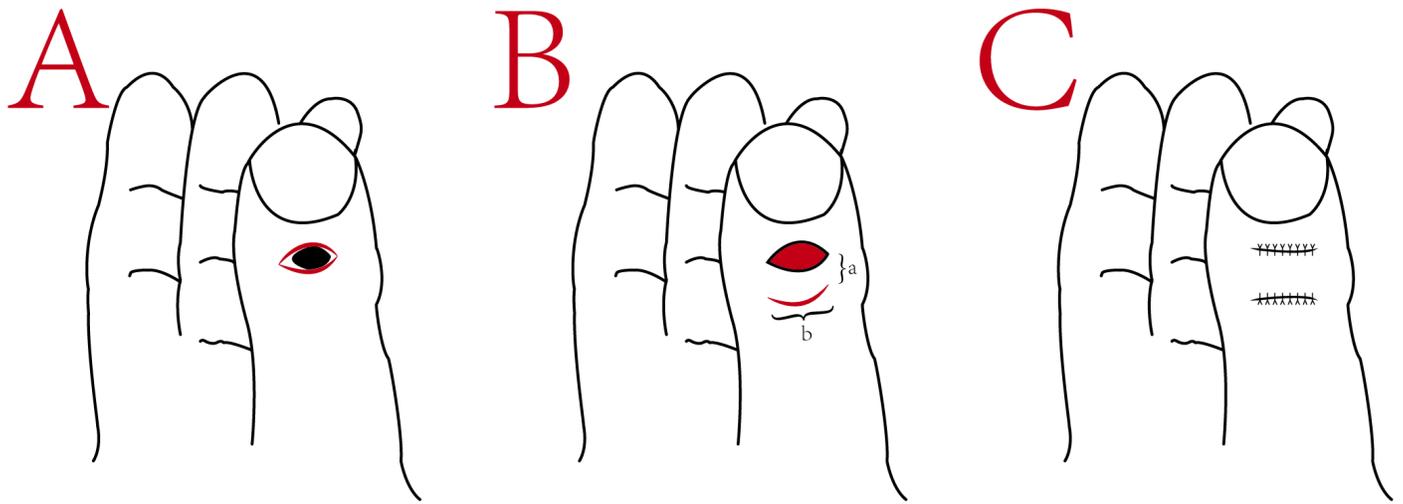


Figure 1

A: A transverse spindle-shaped incision was made around the site of thin skin on the surface of the cyst.
B: New incision with a similar length and arc to the proximal edge of the incisional defect was made at the proximal side of the defect ($a:b \geq 1:2$). C: The incision was sutured.

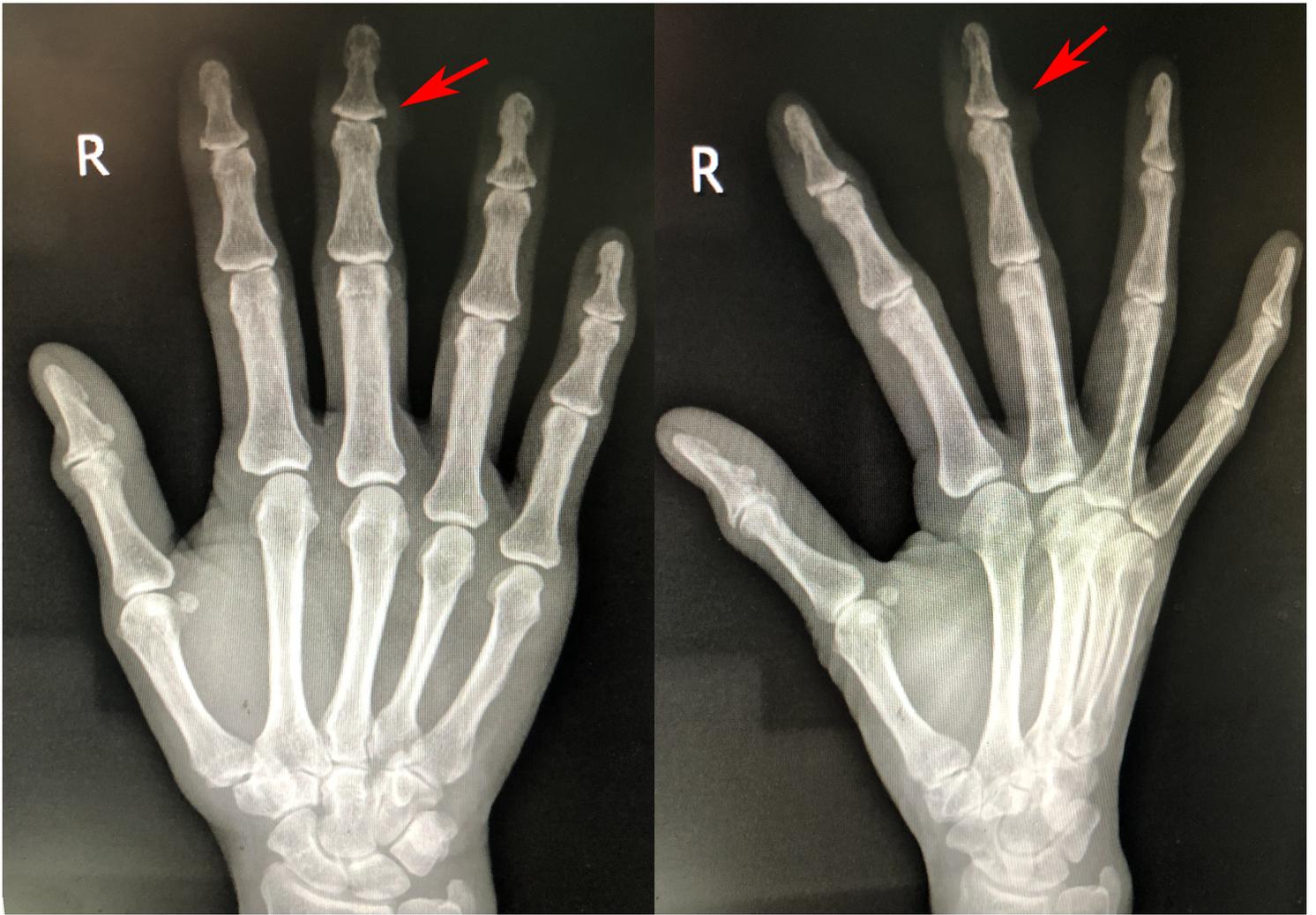


Figure 2

Preoperative AP and Oblique radiography: The osteophyte was shown (Red arrow).

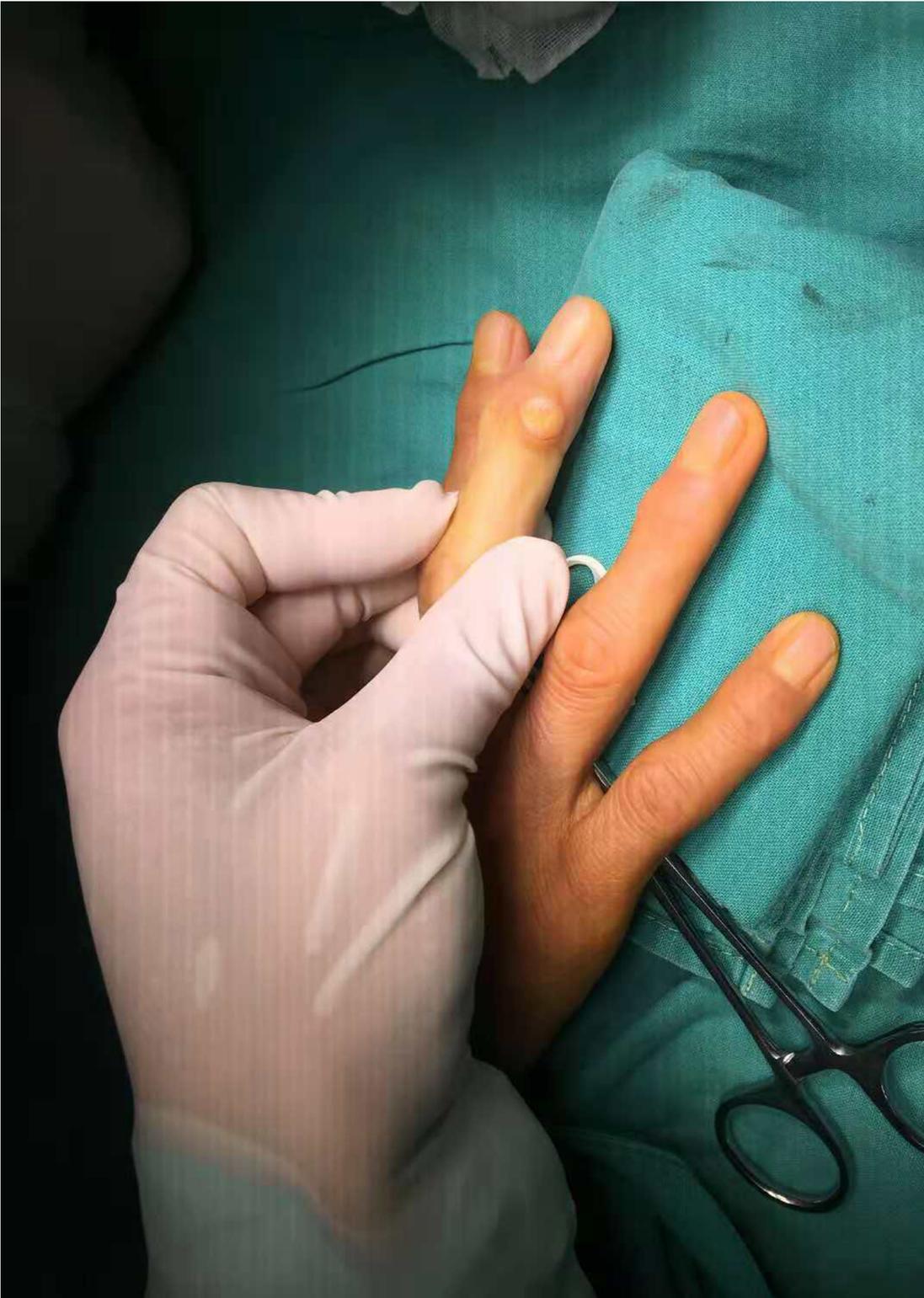


Figure 3

A transverse spindle-shaped incision was made around the site of thin skin on the surface of the cyst, and the length of the incision exceeded that of the cyst.

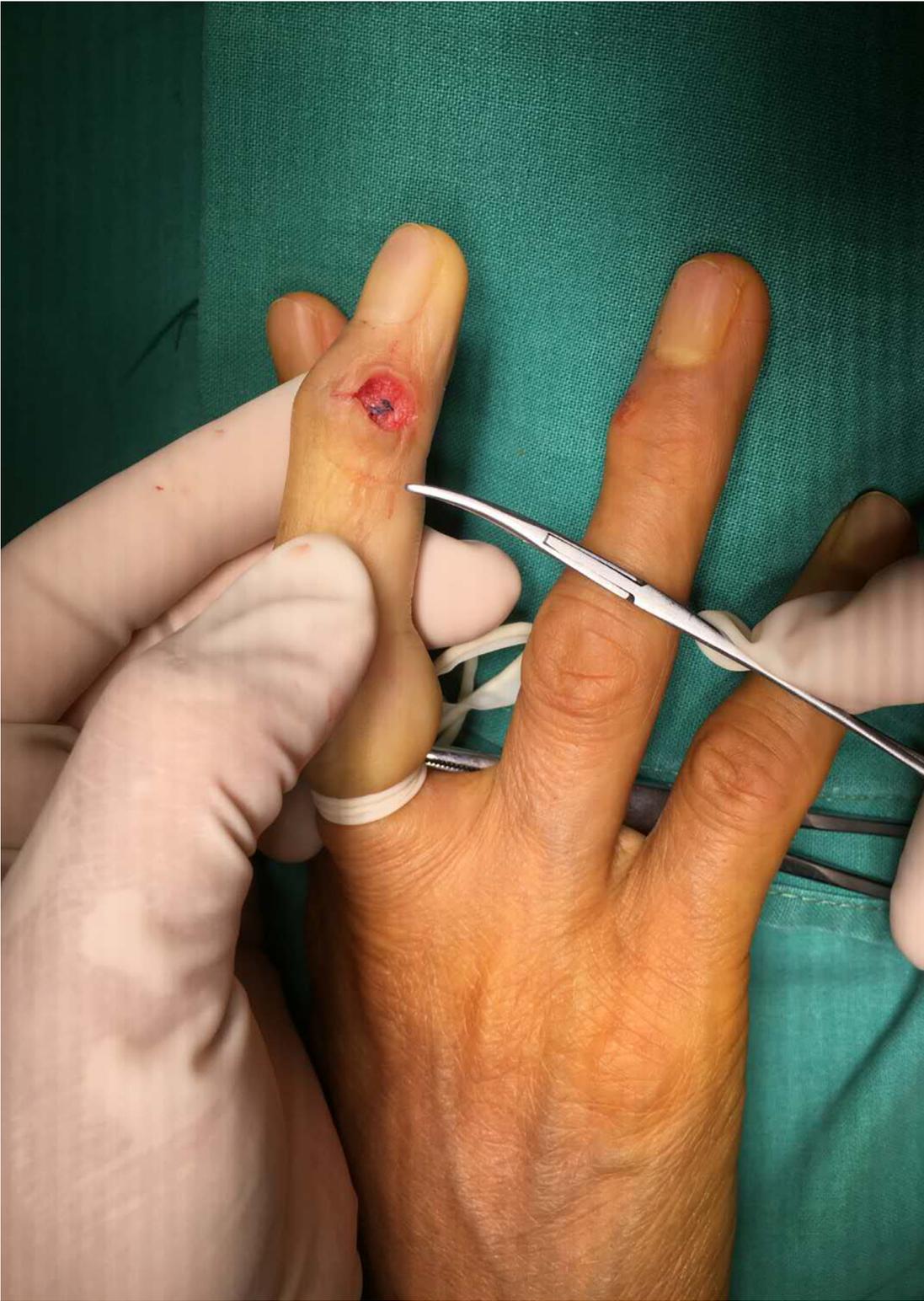


Figure 4

The thin skin was excised with the cyst. Then, a new incision with a similar length and arc to the proximal edge of the incisional defect was made at the proximal side of the defect.

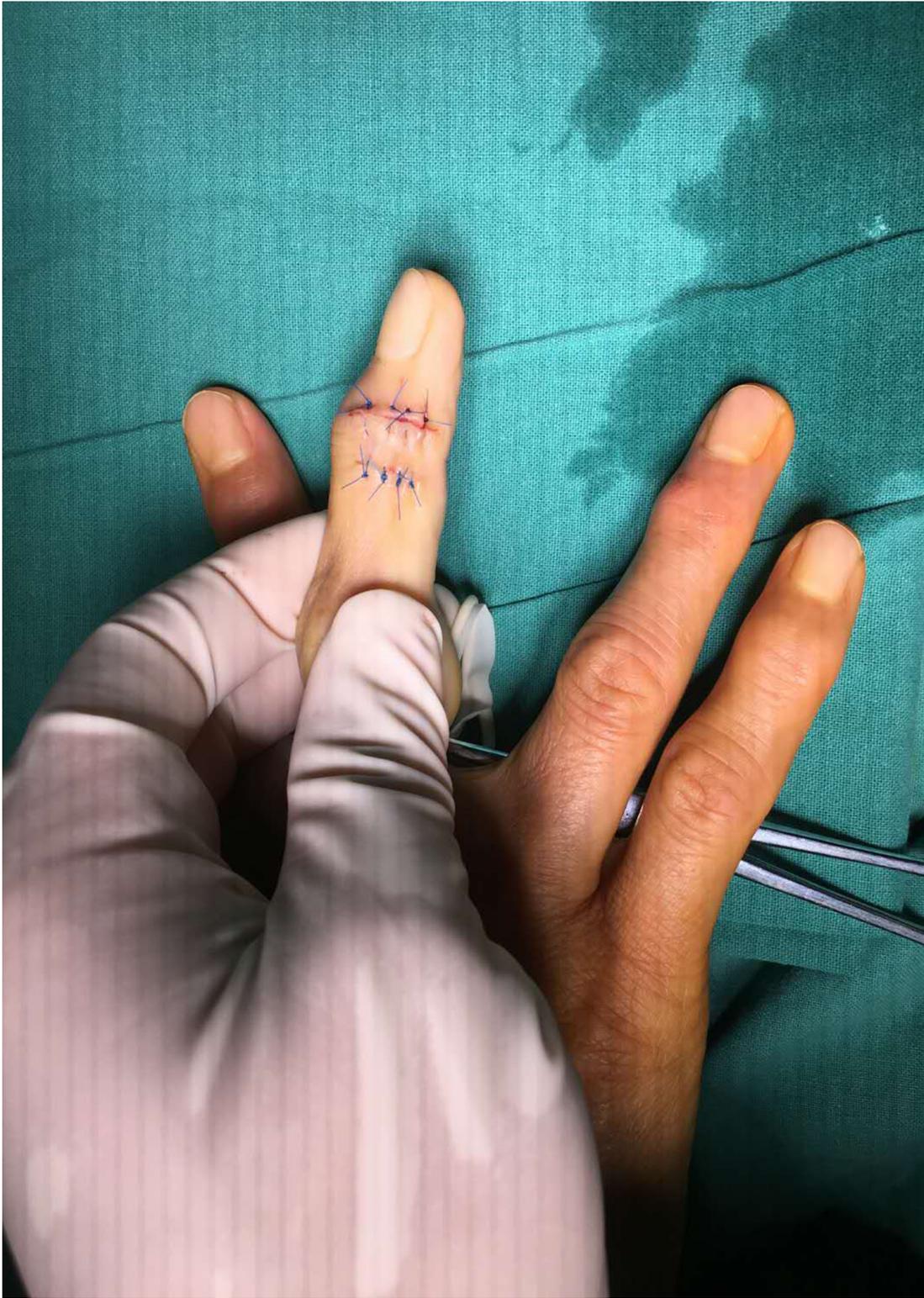


Figure 5

The defect was covered with the bipedicle advancement flap.



Figure 6

Postoperative AP and Oblique radiography: The osteophyte was completely removed (Red arrow).

Supplementary Files

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