

Combination Therapy Composed of Surgery, Postoperative Radiotherapy, and Wound Self-management for Umbilical Keloids

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Background: A universally accepted therapeutic strategy for umbilical keloids has not been determined. Our team has had considerable success with combination therapy composed of surgical excision followed by postoperative radiotherapy and steroid plaster/injection.

Methods: All consecutive patients with umbilical keloids that developed from endoscopic surgical scars and underwent minimal-margin keloid excision followed by umbilicoplasty with a flap if needed, tension-reduction suturing, and postoperative radiotherapy in 2013–2017 in the keloid/scar-specialized clinic at the Department of Plastic, Reconstructive and Aesthetic Surgery of Nippon Medical School. The postsurgical radiotherapy regimen was 15 Gy administered in 2 fractions over 2 consecutive days. Radiotherapy was followed by tension-reducing wound self-management with silicone tape or, if needed, steroid plaster. The primary study focus was keloid recurrence during the 24-month follow-up period. Recurrence was defined as the growth of stiff red lesions in even small areas of the scar that was refractory to 2–6 months of steroid-plaster therapy.

Results: The case series consisted of 34 patients with 34 lesions. Three lesions (8.8%) recurred. One recurrence was successfully treated by concomitant steroid plaster/injection. The other 2 cases were resistant to steroid injection and underwent reoperation without radiotherapy followed by 6 months of steroid-plaster therapy. None of the 3 cases recurred within 2 years of steroid plaster/injection completion or reoperation.

Conclusion: Umbilical keloids can be successfully treated by customized treatment plans that involve appropriate surgical modalities (including umbilicoplasty, if required), postoperative radiotherapy (15 Gy/2 fractions/2 days), and wound/scar self-management with silicone tape and steroid plaster. (*Plast Reconstr Surg Glob Open* 2020;8:e3181; doi: [10.1097/GOX.0000000000003181](https://doi.org/10.1097/GOX.0000000000003181); Published online 29 October 2020.)

INTRODUCTION

Keloids are a dermal fibroproliferative disease that is driven by persistent inflammation in the reticular dermis.¹ The prevalence of umbilical keloids is increasing because minimally invasive laparoscopic surgery that involves placing a port in the umbilicus has recently become the mainstream surgical treatment for gastrointestinal, urological,

and gynecological diseases.^{2–4} These patients also often develop painful abscesses because although some umbilical keloids spread horizontally (like most other keloids), the others grow in the vertical direction according to incision line of the keloid-causing surgery. If the umbilical keloid grows vertically, it can acquire a mushroom shape (similar that seen in auricular keloids) that fills the space of the umbilicus with keloid tissues. This in turn can yield inclusion cysts that become infected and develop into abscesses.^{2,5}

The main risk factors for the formation of surgery-induced umbilical keloids include genetic predisposition, infection in the surgical wound that delays its healing, and cyclic mechanical stretching of the wound due to breathing and posture changes.^{1,2,6–8} On the basis of these observations, we have developed a combination treatment strategy. The strategy consists of surgical excision followed by postoperative radiotherapy, wound stabilization with

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pressure therapy, sheeting, or silicone tape, and, if a recurrence appears to be emerging, steroid tape application and steroid injection.^{1,2,9} To confirm the effectiveness of this combination therapy, we analyzed all umbilical keloid cases, regardless of the size of the keloid, that were treated with this strategy in our facility in 2013–2017. We discuss the concepts underlying this therapeutic strategy and its limitations for umbilical keloids.

METHODS

Ethics Statement

This case-series study was performed after obtaining approval from the Ethics Committee of Nippon Medical School Hospital. The retrospective nature of the study meant that patient consent was not needed.

Patient Selection

A retrospective medical chart review identified all consecutive adult patients with umbilical keloids who (1) underwent keloidectomy in 2013–2017 in the outpatient clinic of the keloid/scar-specialist clinic in the Department of Plastic, Reconstructive and Aesthetic Surgery, Nippon Medical School (Tokyo, Japan) and (2) were followed up for at least 24 months. All patients with a single umbilical keloid or multiple abdominal keloids (including an umbilical keloid that developed from endoscopic surgical scars) were selected. Of those, the patients who underwent complete umbilical keloid excision (with umbilicoplasty, if required) followed by the postoperative radiation and wound self-management protocol described below were included in this case-series study. Keloid was defined as a continually growing elevated red scar while hypertrophic scar was defined as a hard, mildly elevated scar with limited growth. Patients with hypertrophic scars were excluded from this study along with patients with multiple umbilical keloids who were treated by conservative therapies or partial resection only.

Surgical and Postoperative Radiation Treatment Protocol

All study patients were treated with a protocol consisting of complete excision, umbilicoplasty if required, closure with the fascial suture method (if possible), minimal dermal suturing, postoperative adjuvant radiotherapy, and postsurgical wound self-management using silicone tape and steroid plaster. In this study, umbilicoplasty was defined as surgery with flaps that restored the umbilical depression; surgery where the umbilical depression was created by simply tacking the remaining normal skin to the anterior rectus sheath was not considered here to be an umbilicoplasty.

When excising the keloid mass, it is necessary to carefully resect only the keloid tissue such as core excision methods: this is because overcutting could injure the intestinal tract.⁵ In cases where keloid resection resulted in the loss of the umbilical depression and surrounding healthy skin to tack, flaps were designed on the surrounding healthy skin. The umbilical depression was reconstructed by placing 2-0 or 3-0 polydioxanone sutures (PDSII; Ethicon, Inc., Somerville, N.J.) between the anterior rectus sheath and the bottom of the flap or remained

healthy skin, and superficial fascia sutures were added surrounding the umbilicus, if needed. Regardless of whether umbilicoplasty was performed or not, the fibrous membrane in the fatty tissues just below the subdermal vascular network (ie, the upper superficial fascia) was then sutured with 3-0 or 4-0 PDSII.¹⁰

After confirming that the wound edges were smoothly elevated without any tension by the underlying sutures, the dermis was closed with 5-0 or 4-0 PDSII sutures.¹¹ In our case series, the average pitch between each dermal suture was 1–1.5 cm. At the end of surgery, superficial sutures with 6-0 polypropylene (Proline; Ethicon) were added.

Postoperative radiotherapy with a 4-MeV electron beam that delivered a total radiation dose of 15 Gy was administered in 2 fractions over 2 consecutive days.¹² The fractions were delivered immediately after surgery if the surgery was conducted on a Wednesday (ie, radiotherapy on Thursday and Friday) or after the weekend if the surgery occurred on Friday (ie, radiotherapy on Monday and Tuesday).

After the sutures were removed 7–14 days after surgery, the patients were requested to stabilize their wound/scar with 24 h/day silicone taping, and to continue this for >6 months. The patients were advised to remove the sheet before bathing, to wash the umbilicus in the bath, and then reuse the sheet. If the sheet lost its adhesiveness, the patients were instructed to change to a new sheet.

Patient Follow-up and Additional Therapies

All patients visited the outpatient clinic 2–3 months after the surgery and every 2–6 months thereafter. The total follow-up duration exceeded 24 months. If the postoperative scar exhibited stiffness with redness in even small areas, silicone tape was discontinued and replaced with anti-inflammatory steroid plaster (Eclar plaster; Hisamitsu Pharmaceutical Co., Inc., Tokyo, Japan).^{2,13} In this case, the patient was asked to change the plaster daily but to wear it 24 hours/day. It was planned that if the stiffness and redness had disappeared at the next visit 2–6 months later, the steroid plaster would be replaced with heparinoid ointment (Hirudoid Soft Ointment; Maruho Co., Inc., Osaka, Japan) to keep the scar surface moist. However, if the steroid plaster could not eliminate the stiffness/redness after 2–6 months, the lesion was deemed to have recurred, and steroid injection was added to the steroid-plaster administration. Steroid injection involved a single injection via a 30 G needle of 1–2 mL of 5 mg triamcinolone acetonide [TAC (Kenacort; Bristol-Myers Squibb K.K., Tokyo, Japan)] diluted with 1% lidocaine.

Primary Study Outcome and Other Variables

The primary outcome was recurrence in the 24-month follow-up period, where recurrence was defined as stiffness with redness even in tiny areas of the postoperative scar that were refractory to 2–6 months of steroid-tape treatment. Other variables were original keloid size, presence of postoperative complications (eg, wound dehiscence, pigmentation, depigmentation, or telangiectasia), how often silicone tape was replaced with steroid plaster,

duration of silicone tape and steroid plaster use, number of steroid injections before recurrence disappearance was observed, the postoperative durations to lesion recurrence and scar maturation (defined as scars lacking redness), and scar width at 24 months.

Statistics

All variables were expressed as means or frequency. Groups were compared by using Student's *t* test or χ^2 test. All statistical analyses were performed by using Microsoft Excel 97–2003 (Microsoft Corp, Redmond, Wash.) and SPSS statistical software (SPSS, Chicago, Ill.). *P* values of <0.05 were considered to indicate statistically significant differences.

RESULTS

The case series consisted of 34 consecutive patients with 34 lesions. The mean age of the patients was 52.6 years, and 14 were men and 20 were women, respectively. Eight patients also had keloids on other body sites. Of the 34 umbilical lesions, 9 (26.5%) and 25 (73.5%) were ≤ 2 cm and >2 cm in diameter, respectively, and 10 (29.4%) and 24 (70.6%) were excised with and without flap-based umbilicoplasty, respectively. Typical examples of the surgery with and without umbilicoplasty are shown in Figures 1–5.

Of the 34 keloid-excision scars, 7 (20.6%) exhibited small areas of stiffness at 3 postoperative months and silicone tape was replaced with a steroid plaster. Three months after starting steroid plaster, the stiffness had not resolved in 3 cases. Thus, the lesions were considered to be recurrences and a 5-mg TAC injection was administered immediately. Steroid-tape therapy was continued. In 1 case, the lesion vanished 9 months after the steroid injection (ie, 15 months after surgery), and the steroid tape was replaced with heparinoid ointment. The other 2 cases did not respond to the steroid injection and therefore underwent reoperation without postoperative radiotherapy 12 months after the first operation. Steroid plaster was placed over the reoperation wounds/scars, starting 3 weeks after surgery and continuing for 6 months. No recurrence was observed in these 2 cases over the 2 years after reoperation. Thus, the recurrence rate in our series was 8.8% (3/34 lesions).

The 3 patients with recurrence were all women and all had keloids on other body sites. At a statistical level, the recurrence group was significantly more likely than the nonrecurrence group to have multiple keloids (37.5% versus 0%; *P* = 0.009) but not significantly more likely to be female (0% male versus 15.0% female; *P* = 0.251) and to have a large preoperative keloid size (13.6% >2.0 versus 0% ≤ 2.0 ; *P* = 0.276).

At 24 postsurgical months, the width of the 32 scars left by resection of the original keloid and the 2 scars left by reoperation in the 2 recurrence cases all ranged from 1 to 2 mm. The long-term postoperative complications consisted of pigmentation on the irradiated area in 6 cases (17.6%) 6 months after surgery. None of the patients exhibited telangiectasia 24 months after surgery. Moreover, there were no cases of depigmentation or wound dehiscence after radiotherapy. Typical scars at 24 months can be seen in Figures 1–5.

DISCUSSION

Our current umbilical keloid therapy protocol consists of keloid mass excision with a minimal margin (with umbilicoplasty, if it is needed) followed by tension-reduction suturing, postoperative radiotherapy, and diligent postoperative wound self-care. The present study of 34 cases of umbilical keloids showed that the recurrence rate was only 8.8% (3 cases). Moreover, the steroid-plaster treatment extinguished the early signs of recurrence in 4 other cases while the steroid injection approach successfully quelled the recurrence in 1 of the 3 recurrence cases. These good results are notable, given that keloids in general have very high recurrence rates after excision alone (range, 45%–100%).¹⁴

Characteristics of Umbilical Keloids and Tips and Pitfalls Relating to Their Surgical Treatment

Incision Direction

A major risk factor for keloid formation is high skin tension, which provokes inflammation in the injured dermis that, if prolonged, can lead to pathological scarring.¹¹ Some body sites are more prone to high skin tension than others and thus are much more likely to develop keloids after surgical incision or other skin trauma. One of these high-tension sites is the abdomen: this explains why the

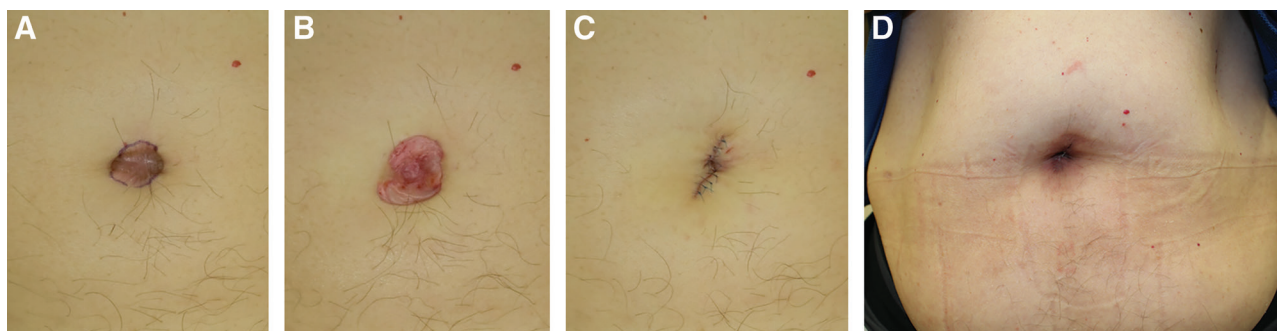


Fig. 1. The case of a 59-year-old man with an umbilical keloid. A, Preoperative view. The umbilical keloid has a mushroom shape due to vertical growth. B, Intraoperative view after minimal margin core excision. C, Postoperative view immediately after closure with subdermal fascial sutures. The umbilicus could be preserved during surgery. Consequently, umbilicoplasty with a flap was not needed. D, Two years after the operation.



Fig. 2. The case of a 46-year-old woman with an umbilical keloid. A, Preoperative view. The umbilical keloid has a mushroom shape due to strong vertical growth. B, Postoperative view immediately after minimal margin core excision and closure with subdermal fascial sutures. The umbilicus could be preserved during surgery. Consequently, umbilicoplasty with a flap was not needed. C, Two years after the operation.

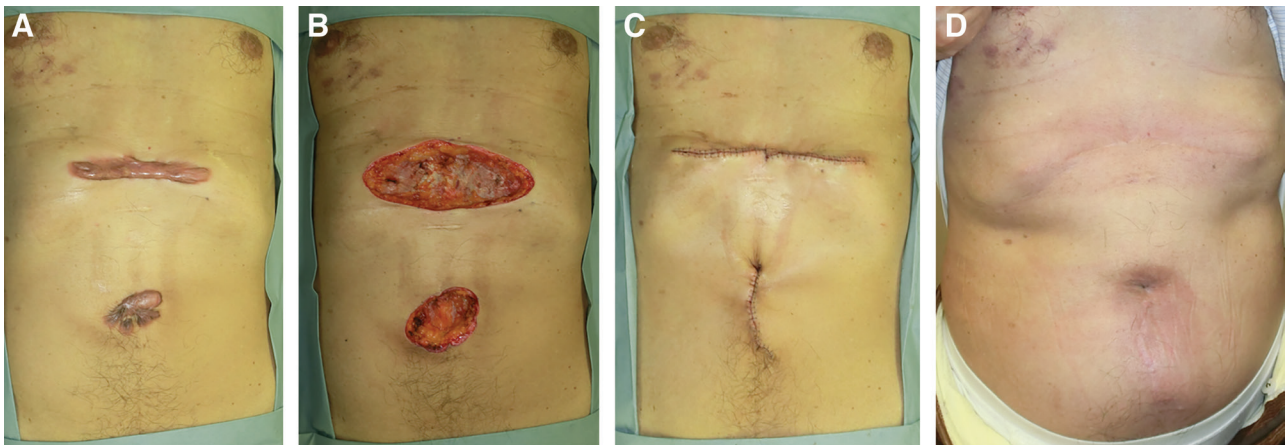


Fig. 3. The case of a 69-year-old man with an umbilical keloid along with another abdominal keloid. A, Preoperative view. The umbilical keloid has a mushroom shape due to vertical growth but also has flatter parts that have radially spread downwards. B, Intraoperative view after minimal margin core excision. The excision eliminated the umbilical depression. The other abdominal keloid was also resected. C, Postoperative view immediately after the remaining umbilical skin was tacked to the anterior rectus sheath. Umbilicoplasty with a flap was not needed. The umbilical and other abdominal wounds were closed with subdermal fascial sutures. D, Two years after the operation.

umbilicus, which is located in the center of the abdomen, is prone to keloid formation after serving as a port during laparoscopic surgery. It should be noted that the abdominal skin is subject to longitudinal skin tension (rather than lateral tension) due to the daily movements of the body.^{7,11} As a result, longitudinal incisions at the umbilicus experience more tension than lateral incisions.⁷ Thus, it is recommended to use lateral incisions in the umbilicus as much as possible during laparoscopic surgery.¹⁵

Keloid Growth Habit

The pattern of umbilical keloid growth should be determined before resection surgery: is the growth mainly vertical, therefore leading to a mushroom shape? This growth habit can be seen in [Figures 1–3](#). Or is the growth mainly horizontal, which leads to more of a pancake/pikelet shape? This pattern is exemplified in [Figure 4](#).

If the keloid has a mushroom shape, it is essential to excise the edge between the keloid and its surrounding normal skin very finely by using minimal margin core excision, thus removing only the hard keloidal tissue. This is important because in most mushroom-like umbilical

keloid cases, this approach will leave enough normal skin in the area to allow relatively tensionless primary closure of the wound while simultaneously preserving the umbilical depression, or allowing umbilicus depression creation by tacking the remaining normal skin to the anterior rectus sheath (an example of such tacking is shown in [Figure 3](#)). The tensionless primary closure of the wound in these cases can be guaranteed by starting with sutures in the upper superficial fascia, which is the fibrous membrane that lies just below the dermis. These superficial fascial sutures can then be followed by dermal sutures and superficial sutures. This approach, which is depicted in [Figures 1–3](#), obviates the need for tension-releasing umbilicoplasty with flaps.

However, if the keloid grows in mainly the horizontal direction (some of these keloids can also show vertical elevation), there may not be sufficient skin after minimal marginal core excision for both tensionless primary wound closure and preservation or creation of the umbilical depression by tacking normal skin to the anterior rectus sheath. In those cases, umbilicoplasty using a flap will be needed. Some subcutaneous fat may have to

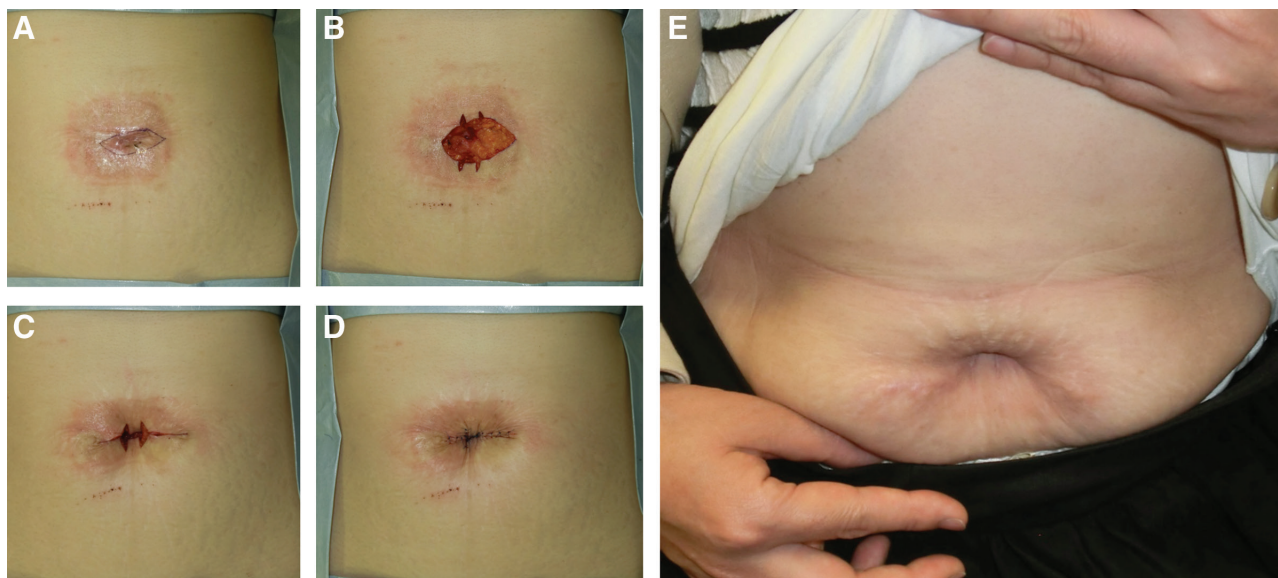


Fig. 4. The case of a 47-year-old woman with an umbilical keloid. A, Preoperative view. The umbilical keloid has a pancake shape due to predominantly horizontal growth. B, Intraoperative view after minimal margin core excision. The excision eliminated the umbilical depression. Flaps were created on both the upper and lower edges of the wound. C, Intraoperative view after the flaps were tacked to the anterior rectus sheath. D, Postoperative view immediately after closure with subdermal fascial sutures. The scar runs in a lateral direction. E, Two years after the operation.

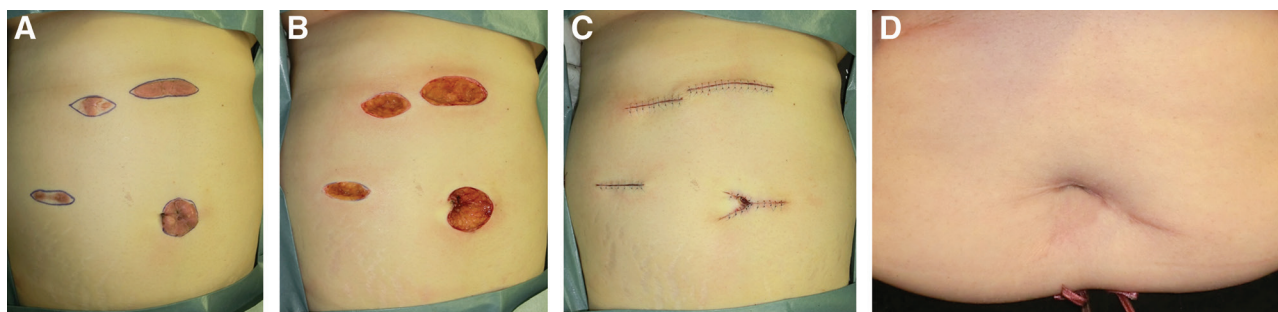


Fig. 5. The case of a 70-year-old woman with multiple abdominal keloids, including an umbilical keloid. A, Preoperative view. The umbilical keloid has a pikelet shape due to predominantly horizontal but also vertical growth. B, Intraoperative view after minimal margin core excision of the umbilical keloid. The excision eliminated the umbilical depression. The 3 other abdominal keloids were also resected. C, Postoperative view immediately after a flap was created on the right side of the umbilicus and closure with fascial sutures was performed. The scar at the umbilicus runs in a lateral direction. The 3 other incisions were closed primarily with fascial sutures. D, Two years after the operation.

be removed from the flap to make it thin enough for the umbilicoplasty. The resulting skin flap can then be tacked to the anterior rectus sheath, thereby creating an umbilicus depression (Figs. 4, 5).

In our case series, all 3 recurrence cases involved umbilicoplasty. Thus, it remains possible that flap umbilicoplasty using the procedure described above does not always adequately eliminate tension on the wound dermis. Surgeons should be aware of this potential problem when reconstructing the wounds left by umbilicus keloid excision with flap-based umbilicoplasty. More stringent application of tension-reducing methods may be warranted in some cases.

Postoperative Radiotherapy

Since postoperative external radiotherapy is the most effective therapy for preventing keloid recurrence after

keloidectomy.^{2,12,16,17} Like the surgical methods for keloids, which are customized for each body site, we use body-site-customized postoperative radiotherapy. This approach is the result of >10 years of work in our institute, wherein we sought to identify the body-site-specific postoperative radiotherapy regimens that yielded low recurrence rates (<10%) with as little radiation as possible, thus limiting the risk of secondary carcinogenesis.^{2,12,18} For umbilical keloids, the regimen consists of an electron beam at a total dose of 15 Gy given in 2 fractions over 2 consecutive/semi-consecutive days starting 1–3 days after surgery. If the intrinsic radiosensitivity and repair capability (ie, the α/β ratio) of keloids is set at 10, this regimen yields a biologically effective dose of 26.25 Gy.^{12,19} We also apply full shielding to protect the normal tissues.²⁰ In our umbilical keloid case series, the patients have been followed up

for at least 24 months; follow-up has extended to 7 years in some cases. Secondary carcinogenesis has not been observed. It should be noted that cases of malignant tumors after modern postoperative radiotherapy protocols have not yet been reported.^{12,18} Nevertheless, we continue to strive to further reduce the radiation dose by developing new surgical methods and irradiation modalities. It should be noted that the 3 recurrence patients in this study also had keloids on other body sites. This suggests that the postoperative radiotherapy dose that we use for umbilical keloids may not be sufficient for multiple-keloid cases (perhaps because they have a strong genetic predilection to keloids) and that it may be necessary to further customize the radiotherapy dose by factoring in keloid-related factors (eg, keloid number) that associate with high recurrence rates.

Postoperative Scar Management

The patients in our clinic are routinely encouraged to diligently fix their postoperative scars with silicone tape 24 hours per day for at least 6 months after suture removal. The objective is to decrease external mechanical tension on the wound/scar after the operation.

Despite the use of tension-reducing operative methods, radiotherapy, and tension-reducing silicone-tape fixation, we sometimes have cases in which the postoperative scar develops small areas of stiffness with redness. This indicates the resurgence of inflammation and can be a sign of keloid recurrence. As a result, silicone-taping therapy is immediately replaced with 24-hour steroid-plaster application; alternatively, the steroid plaster can be placed on the stiff area under the silicone tape.¹³ This treatment is readily self-administered, and our case-series study here showed that it completely eliminated the new inflammation in 4 of 7 cases. If the steroid plaster does not improve the stiffness of the scar within 2–6 months (at which point it is considered a recurrence), TAC injection was performed.²¹ In our case-series study, 1 of the 3 recurrence cases responded completely to this salvage therapy, which suggests that it can have good long-term outcomes. However, the remaining 2 recurrence cases were refractory to steroid injection and had to undergo reoperation. Since these cases were not retreated with postoperative radiotherapy (to limit the risk of secondary carcinogenesis), the patients were asked to apply steroid plaster 24 hours/day starting 3 weeks after reoperation. It was planned to continue this treatment until the scars had lost their redness and stiffness. In both of our cases, the steroid plaster could be changed to silicone tape 6 months after reoperation. Thus, our case-series study here shows that careful and thorough postoperative scar self-management and close follow-up to eliminate the smallest signs of recurrence is a very important adjunct to the surgical and radiotherapy strategies for umbilical keloids.

It should be noted that this postoperative scar management strategy was effective in our series because we could use 20 µg/cm² deprodone propionate plaster, which is commercially available in Japan and effectively treats keloids as well as abnormal postoperative scarring (including stiff scars).¹³ Deprodone propionate is a

higher-potency steroid. In contrast, the only commercially available steroid plasters in the United States of America and the United Kingdom contain medium-strength steroids (4 µg/cm² flurandrenolide or fludrocortide). In this case, it may be necessary to consider administering steroid injections immediately after stiffness is observed rather than first trying steroid plasters.

CONCLUSIONS

The present study showed that umbilical keloids can be successfully treated by body site–customized plans that involve appropriate surgical modalities (including umbilicoplasty, if needed) followed by postoperative radiotherapy (15 Gy in 2 fractions over 2 days) and scar self-management with silicone taping and steroid plaster. The long-term safety of our radiotherapy regimen will be carefully assessed by attentive surveillance of our growing case series.

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