Purse-String Suture for Round and Oval Defects: A Useful Technique in Dermatologic Surgery

Jian-Wei Zhu, Xian-Jie Wu, Zhong-Fa Lu, Sui-Qing Cai, and Min Zheng

Background: Round and oval skin wounds, like facial pigmented nevi after excision are traditionally sutured linearly for closure, leaving significant scars, which greatly influences their appearance.

Objective: This article provides an overview of our experience using intradermal purse-string suture for round and oval defects in the faciocervical region to ascertain whether purse-string suture closure for such defects can result in good functional and cosmetic outcomes.

Methods and Results: We present 63 cases with different skin lesions in the faciocervical area. The defects of the lesions after excision were closed using intradermal purse-string suture. The wounds showed good final healing without obvious adverse events postoperatively. The result of scar assessment using the Vancouver Scar Scale was satisfying, with a total score of only 1.11. The final cosmetic appearance of the healed wounds seemed to be excellent and acceptable as they were always smaller than the original defects, with minimal scarring.

Conclusion: Purse-string suture enabled us to repair small, circular wounds easily after excision of skin lesions. It is an excellent alternative to other reconstructions and a rapid, simple method to close skin defects with minimal scarring, achieving an excellent long-term cosmetic and functional outcome.

ROUND AND OVAL SKIN LESIONS, like facial pigmented nevi, are common and are traditionally sutured linearly for closure after excision, leaving scars longer than the nevi themselves, which greatly influences their appearance. Multidirectional advancement closure has been advocated as useful in circular skin defects following surgical management of hemangiomas and Mohs surgery, reducing the wounds by approximately 53 to 70% depending on their size and creating the smallest possible scar.1–3 The use of this technique at various...
anatomic sites was described, and its usefulness has been substantiated.\textsuperscript{4,5} Since 2007, we have successfully used the purse-string suture for round and oval defects in the faciocervical region, especially when they are adjacent to structures that can be deformed, such as the eyelids, eyebrows, and lips, with the goal of restoring normal anatomic contour while minimizing the size of the permanent scar. Herein we present an overview of our experience using this technique and the satisfactory results from 63 cases.

Materials and Methods

This study was approved by the Zhejiang University Institutional Review Board. Patients were recruited from the dermatology practice of Second Affiliated Hospital, Zhejiang University, School of Medicine. Specifically, patients with circular lesions in the faciocervical area were invited to participate. Exclusion criteria included previous patient experience of keloids or atypical scars and known patient hypersensitivity to any of the surgical materials. Informed consent was obtained from all willing participants before surgery. The period of recruitment was from August 2007 to August 2009. The period of follow-up was from August 2007 to April 2010.

There were 24 males and 39 females enrolled, 4 to 55 years old, with a mean age of 27.6 years. The skin lesions were located in the scalp, frontal areas, eyebrows, nose tip, preauricular areas, perioral areas, periorbital areas, nasolabial grooves, mandible areas, and neck. The diameter of these skin lesions ranged from 6 to 20 mm, with a mean of 14.2 mm, as larger defects could not be reproducibly closed using purse-string suture alone to deliver an excellent cosmetic result. The diagnoses of the lesions were subsequently histologically determined to be pigmented nevus, congenital pigmented nevus, blue nevus, epithelioid cell nevus, epidermal nevus, dermoid cyst, sebaceous nevus, and cutaneous horn. These variables, including the incidence and type of postoperative complications, are listed in Table 1.

Three dermatologic surgeons, including a general one (J.-W.Z.) and two fellowship surgeons (X.-J.W. and Z.-F.L.), were the treating physicians. Each of them had obtained their surgical training at the same institution, under the mentorship of the same teaching surgeons. Prior to the inception of the treatment, the participating surgeons had a meeting to discuss the precise definitions and methodology of this study to ensure intersurgeon consistency of surgical technique. Then each surgeon began enrolment of patients and accumulated 31, 20, and 12 patients, respectively.

Table 1. Summary of Characteristics of Patients in Whom 63 Purse-String Closures Were Performed

<table>
<thead>
<tr>
<th>Skin Lesions</th>
<th>Number of Patients</th>
<th>Age (yr), Range (mean)</th>
<th>M:F</th>
<th>Locations</th>
<th>Size of Defects (mm), Range (mean)</th>
<th>Complications (case)</th>
<th>VSS Scores (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigmented nevus</td>
<td>22</td>
<td>16–45 (22.8)</td>
<td>6:16</td>
<td>Face, eyebrow, nose tips, preauricular areas, perioral areas, periorbital areas, neck</td>
<td>6–14 (9.4)</td>
<td>None</td>
<td>0.86</td>
</tr>
<tr>
<td>Congenital pigmented nevus</td>
<td>18</td>
<td>7–32 (16.3)</td>
<td>7:11</td>
<td>Face, nasolabial grooves, perioral areas, neck</td>
<td>8–20 (14.6)</td>
<td>Contact dermatitis (1)</td>
<td>1.28</td>
</tr>
<tr>
<td>Blue nevus</td>
<td>11</td>
<td>13–39 (29.6)</td>
<td>3:8</td>
<td>Face, upper lips, mandible areas, frontal areas, neck</td>
<td>6–13 (8.9)</td>
<td>None</td>
<td>0.73</td>
</tr>
<tr>
<td>Epithelioid cell nevus</td>
<td>1</td>
<td>8</td>
<td>1:0</td>
<td>Left submandibular area</td>
<td>18</td>
<td>None</td>
<td>3</td>
</tr>
<tr>
<td>Epidermal nevus</td>
<td>3</td>
<td>16–45 (23.8)</td>
<td>3:0</td>
<td>Scalp, right frontal area, right postauricular area</td>
<td>14–19 (16.7)</td>
<td>Wound infection (1)</td>
<td>2.33</td>
</tr>
<tr>
<td>Dermoid cyst</td>
<td>2</td>
<td>4–5 (4.5)</td>
<td>0:2</td>
<td>Orbital area, root of nose</td>
<td>15–18 (16.5)</td>
<td>Hypertrophic scar (1)</td>
<td>3.5</td>
</tr>
<tr>
<td>Sebaceous nevus</td>
<td>4</td>
<td>7–16 (13.5)</td>
<td>10:16 (13)</td>
<td>Scalp</td>
<td>10–16 (13)</td>
<td>Wound infection (1)</td>
<td>1.5</td>
</tr>
<tr>
<td>Cutaneous horn</td>
<td>2</td>
<td>43–55 (49)</td>
<td></td>
<td>Frontal areas</td>
<td>7–14 (10.5)</td>
<td>None</td>
<td>1.5</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>3–55 (27.6)</td>
<td>24:39</td>
<td>Face, scalp, neck</td>
<td>6–20 (14.2)</td>
<td>4</td>
<td>1.11</td>
</tr>
</tbody>
</table>

VSS = Vancouver Scar Scale.
The outcome measure was the Vancouver Scar Scale (VSS; Table 2), which is widely used in clinical practice and research to document changes in scar appearance, measuring vascularity, pigmentation, pliability, and height on a 0- to 3-point ordinal scale and pliability on a 0- to 5-point scale. An additional item was added to assess the degree of pruritus (also on a 0- to 3-point scale). Scars were assessed 6 months after surgery.

Table 2. Vancouver Scar Scale plus Pruritus

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<tr>
<td></td>
<td>Normal 0</td>
<td>Normal 0</td>
<td>Normal 0</td>
<td>Normal 0</td>
<td>Normal 0</td>
</tr>
<tr>
<td></td>
<td>Pink (slight increase in blood supply) 1</td>
<td>Hypopigmentation 1</td>
<td>Supple (flexible with minimal resistance) 1</td>
<td>&lt; 2 1</td>
<td>Normal 0</td>
</tr>
<tr>
<td></td>
<td>Red (significant increase in blood supply) 2</td>
<td>Mixed 2</td>
<td>Yielding (giving way to pressure, offering moderate resistance, but does not behave as a solid scar mass) 2</td>
<td>2-5 2</td>
<td>Mild 1</td>
</tr>
<tr>
<td></td>
<td>Purple (excessive local blood supply) 3</td>
<td>Hyperpigmentation 3</td>
<td>Firm (solid/inflexible unit, not easily moved, resistant to manual pressure) 3</td>
<td>&gt; 5 3</td>
<td>Moderate 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ropes (rope-like tissue that blanches with extension of scar; does not limit range of motion) 4</td>
<td></td>
<td>Severe 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contracture (permanent shortening of scar producing deformity or distortion; limits range of motion) 5</td>
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The surgical technique involved the following steps:

1. **Surgical Technique**

   After routine sterilization and local anesthesia, the lesions were incised with a margin of approximately 2 mm around their edges, and purse-string suture was used to repair the wounds, with nonabsorbable nylon suture from 6-0 (smallest) to 1-0 (largest) in diameter, beginning with the insertion of the needle into the dermis and emerging from the dermis before it exits from the dermis toward the center of the wound. Approximately 4 mm from the dermal exit site, the needle is again inserted. This sequence of needle insertion into the dermis, horizontal dermal advancement of the needle, and needle exit from the dermis is continued until the entire circumference of the defect has been sutured. Complete or partial closure results when the purse-string of the suture is gently pulled taut and tied.

   Several modifications in the purse-string suture technique have sometimes been applied: (1) simple interrupted sutures are used for closure of the epidermis of the purse-string suture–reduced defect, which helps relatively larger defects heal in a shorter time than the buried dermal suture; (2) the purse-string suture is placed only around part of an oval defect to avoid distortion of a nearby free margin; and (3) in easily distorted areas such as...
the eyelids and lips, we choose the insertion site of the needle side by the eyes or mouth; after completing the entire circumference, we pull the suture toward the side of the eyes or mouth and undermine the margins of the defects so that distortion is minimized.

Results

The duration of time necessary for complete healing depended on the depth and diameter but not the location of the defects. Most wounds required between 6 and 12 weeks for complete resolution with either an oval or a linear scar. Occasional wounds had healed as early as 4 weeks. Erythema at the suture line along the circumference of the wound was noted in most patients. The redness and focal tenderness could be interpreted to represent a localized reaction to the nonabsorbable suture and often prompted earlier removal of the suture. Thereafter, the symptoms resolved within the next few days. Postoperative complications occurred only in four patients: contact dermatitis to antibiotic ointment (one), wound infection (two), and hypertrophic scar (one). The former two complications were noted within the first week of follow-up and resolved soon after treatment. The hypertrophic scar was flattened after five local injections of Diprospan, with a dosage of 0.2 mL/cm² each time. Other drawbacks include the following: (1) resolution of cutaneous erythema is prolonged; (2) a number of skin bulges formed outward in the immediate postoperative period but naturally disappeared several weeks after operation; and (3) scars sometimes were depressed or stellate but were always minor and acceptable. Postoperative pain was seldom; for patients with severe or persistent pain, oral ibuprofen, sustained-release capsules 600 mg twice a day, was recommended for adults and acetaminophen granules 15 mg/kg three times a day for children.

Generally, most of the wounds showed good final healing postoperatively without obvious adverse events. Scar assessment using the VSS was satisfying, with a total score of 1.11 (see Table 1). The cosmetic appearance seemed to be excellent and acceptable because the scars were always shorter than the original defects, with minimized scarring at the sixth month of follow-up. One typical case is that of a 29-year-old female who presented with a pigmented nevus in the left upper lip, 9 mm in diameter, with some short black hair. Six months after excision, we found no significant scarring or suture marks, and the lips were symmetrical, with a perfect appearance (Figure 3).

Discussion

Several options are available for treating round and oval defects following the surgical extirpation of a skin lesion, including second-intention healing by allowing the wound...
to granulate, a layered side-to-side closure of the wound edges, the placement of nonadjacent tissue using a partial- or full-thickness skin graft, and local skin flaps that transfer adjacent tissue. Most of them refer to large wounds, with a size above 30 mm. Greenbaum and Radonich first introduced the purse-string closure, which eliminates the excision of healthy skin adjacent to the wound, providing as the primary closure for small round skin defects or as a partial closure for larger defects by reducing the wound area. Subsequently, several uses of the purse-string suture have been described. The intradermal purse-string suture was used to repair not only post-operative cutaneous wounds involving the umbilicus, urethra, and breast but also surgical defects following the removal of skin cancer. In addition, the purse-string suture has been used for improving or creating nipple projection in patients with inverted or ill-defined nipples.

Most researchers used nonabsorbable sutures, and monofilament sutures were preferred to braided sutures. The advantages of monofilament sutures for purse-string closure include (1) decreased tissue drag from the suture, which made it easier to draw the purse string together; (2) decreased theoretical risk for the suture to become a nidus of infection; and (3) easier removal of the suture as it was more slippery. The thickness of the sutures we placed ranged from 6-0 (thinnest) to 1-0 (thickest), and we usually used sutures with larger diameters (3-0 to 1-0). The sutures with smaller diameters (4-0 to 6-0) were used for small wound (6—8 mm) closure at locations in which the skin was thinner, such as the eyelids. It is suggested that absorbable monofilament suture material not be used for wounds in areas of high tension and at risk for dehiscence as the suture loses 60 to 70% of its original strength after 14 days and 100% of its original strength after 3 to 4 weeks.

The optimal duration recommended for the purse-string suture to remain intact varies. Most investigators elected to remove the intradermal purse-string suture after 3 or 4 weeks. Considering that the surgical defects in our study were relatively smaller and had less skin tension, we usually removed the purse-string suture after 7 to 20 days according to the wound size.
The advantages to not undermining the surgical wound border when an intradermal purse-string suture is used include allowing the edges to maintain maximum vascularity and permitting the final scar to mature along the natural lines of relaxed skin tension.11,16 But we sometimes undermine the margins of the defects adjacent to structures that can be deformed. The reasons for advocating that the border of the postoperative defect be undermined to enhance wound closure when an intradermal purse-string suture is used include (1) promoting easier sealing of the wound; (2) facilitating eversion of the wound edges; (3) minimizing rippling of the perimeter of the defect; and (4) decreasing both the morbidity and the potential bleeding that would otherwise be associated with mobilizing a large flap.16,17

Potential postoperative complications following the placement of a purse-string suture are allergic contact dermatitis, alopecia, bacterial infection, exuberant granulation tissue, hypertrophic scar, postoperative pain, suture line erythema, and wound dehiscence.3 In our study, 6.35% of patients developed postoperative complications. However, they almost resolved after potent treatment during the following weeks.

The appearance of a postsurgical wound that has been closed with a purse-string suture can be concerning to both the patient and the referring physician. It is important for the physician performing this type of closure to appropriately educate the patient regarding the sometimes unexpected gross initial appearance and the anticipated sequelae for progressive complete healing.4 Often the initial scar is limited in size and almost circular at closure; subsequently, over a period of weeks to months, the scar orients itself along the skin tension lines and is typically shorter than the original defect.16,18,19 Hence, although the primary morphology of the purse-string sutured defect may be unattractive, the wounds often heal with excellent cosmetic and functional results, where the final scars are shorter than the original wound.16,18 Indeed, some of the defects resolve with linear scars that are aesthetically equal or superior to those performed with a layered, side-to-side closure.19

Conclusion

The purse-string suture enabled us to repair small, circular wounds easily after excision of skin lesions, especially in the faciocervical region, and is suitable for people with different skin characteristics. Based on the principle that tensile force converges toward a central point when the purse-string suture is employed after incision of circular lesions, tension placed on the suture uniformly advances the skin from the entire periphery of the wound, resulting in a significant reduction of the defect size by the greatest extent, making it much easier for cells at the wound edge to sprawl to repair the wounds. Also, because the suture compresses both the larger vessels in the reticular dermis and the smaller vessels in the papillary dermis, enhanced hemostasis is achieved. So the wounds heal in the slightest tensile force, reducing the possibility of scar hyperplasia. The transition of the wounds from circles to points by this method, in our point of view, is a kind of leap geometrically. It is an excellent alternative to other reconstructions and a simple method to close skin defects with minimal scarring, achieving an optimal long-term cosmetic and functional outcome.

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References

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