Four Quadrant-Embedded Purse-String Closure for Defects of Benign Skin Tumors Post Circular Excision

Alper Ural, Fatma Bilgen, Mehmet Bekerecioglu

ABSTRACT

Objective: Skin wounds after elliptical removal of benign tumors, are conventially sutured linearly for closure and often result in longer and undesirable scars. We aimed to evaluate the efficiency of four quadrant embedded intradermal purse-string suture closure technique for round defects in order to obtain satisfactory cosmetic outcomes and limited scar.

Materials and Methods: We analysed the features of 143 patients for whom a total of 208 four quadrant embedded purse string sutures were used to completely close their postoperative surgical defects. The location and histopathological types of the tumors removed were noted. Tumors were located in the cervicofacial region, thoracic region, back, lower and upper extremities. The patient and observer scar assessment scale (POSAS) questionairre was utilized to evaluate objective results of the ultimate scar.

Results: The defects of the lesions after excision were closed using intradermal four quadrant buried purse-string suture. The wounds showed good final healing without obvious adverse events postoperatively. Infection occurred only in three patients. The final cosmetic appearance of the healed wounds was satisfying as POSAS scores were 17.74 for patient scar assesment scale (PSAS) and 15.3 for observer scar assessment scale (OSAS).

Conclusion: Four quadrant embedded purse string technique is a simple and useful method to close skin defects after circular resection of lesions. It provides minimal scarring and remarkable patient satisfaction.

Keywords: Benign skin tumors, dermatologic surgery, skin lesions

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Introduction

The most commonly used technique in the treatment of benign lesions is elliptical excision and linear closure. Elliptical excision of round lesions can leave a scar of up to three times the original diameter of the lesion [1]. This technique causes longer scars, even with the intervention of plastic surgeons. Circular excision and various purse-string closure techniques have been previously described in order to restrict the scar's ultimate area. A multivectoral advancement closure has been reported as a convenient method in circular defects of skin for reducing the wounds and achieving the minimum scar [2]. Although several purse-string closure techniques have been defined so far, most of them are impractical because of their complexity, steep learning curve, or longer duration. In this study, we describe an easily applicable modification of the conventional purse-string closure technique and present our experiences from 143 cases with satisfactory results.

Materials and Methods

This study was approved by the institutional review board (Ethics Protocol No: 15, Date: 12.09.2018). Informed consent was obtained from all the participants before surgery. The follow-up period was from September 2018 to April 2019. There were 69 men and 74 women enrolled with a mean age of 27.8 years (range: 18-65 years). A total of 208 lesions were excised from these 143 patients.

The resected lesions were determined as pigmented nevus, congenital pigmented nevus, epidermal nevus, sebaceous nevus, keratoacanthoma, fibroepithelial polyp, pilomatrixoma,

and cutaneous horn following histopathological examination. Of these lesions, 78% were located on the head and neck, 18% on the thorax and back, and 4% on the extremities. The diameter of these skin lesions ranged from 0.52 cm to 2.76 cm, with a mean diameter of 1.48 cm.

Table 1. Total Patient Scar Assesment Scale (PSAS) Scores. Values are presented as average (range)

Items (PSAS)	Average values
Pain	2.32 (1-7)
Itch	2.78 (1-7)
Color	3.12 (2-10)
Stiffness	3.44 (1-9)
Thickness	2.62 (1-10)
Surface	3.46 (1-9)
Total	17.74

PSAS: patient scar assesment scale

Table 2. Total Observer Scar Assesment Scale (OSAS) Scores. Values are presented as average (range)

Items (OSAS)	Average values
Vascularity	3.12
Pigmentation	2.44
Thickness	2.37
Relief	3.16
Pliability	3.21
Surface Area	1
Total	15.3

OSAS: observer scar assesment scale

Table 3. Mean values of patient datas

	min	max	Mean+SD
Age (year)	18	65	27.8±2.24
Lesion size (cm)	0.52	2.76	1.49±0.82
Follow time (month)	6	11	8.2±1.4
POSAS	13	24	17.74±2.36
OSAS	12	19	15.3±3.12

PSAS: patient scar assesment scale; OSAS: observer scar assesment scale

Main Points

- Four quadrant embedded purse string technique allows a safe and good closure of dermal layers in circular defects.
- This technique's advantages basically depend on providing sufficient tension with minimal number of needle bites. Therefore, any dermal ischemia due to redundant needle bites or unnecessary sutures is avoided.
- It is important to inform the patients preoperatively about the radial skin fold image will disappear in a few weeks and it will take months for the final cosmesis.

The Patient and Observer Scar Assessment Scale (POSAS) questionnaire was completed by the patients and the surgeon after 6 months of the surgery [3]. Scar, itching, pain, pigmentation, stiffness, thickness, and surface parameters were rated by patients. Each item was assessed by numeric values from 1 to 10 (where 10 represents the highest level of dissatisfaction). The scar vascularity, pigmentation, thickness, relief, pliability, and surface area were evaluated and rated according to the observer scar assessment scale.

Statistical Analysis

All data were analyzed by using the Statistical Package for the Social Sciences software version 24.0 (IBM SPSS Corp.; Armonk, NY, USA). The minimum, maximum, mean values, and standard deviations were calculated for each patient and clinician variable. General patient and clinician means were calculated (Table 3).

Surgical Technique

Following sterilization and local anesthesia, the lesions were surgically excised in a circular fashion involving a healthy margin of approximately 1-2 mm (Figure 1A, B). Following the removal of the lesions, a four quadrant–embedded purse-string suture was used to repair the defects using polydioxanone (Demediox, USA) or polyglactin 910 (Demecryl, USA) sutures. The types of sutures ranged from 6-0 (smallest) to 3-0 (largest) depending on the size and localization of the defect. The distance between the intake point of the needle into the dermis and exit from the dermis was about 2-3 mm. The first needle entrance point was received as a reference point (0°). The needle was again inserted in the dermis from three other quadrants of 90°, 180°, and 270° (Figure 2). The needle finally emerged 2-3 mm laterally from the entrance point after going through all the four quadrants. After this, the purse-string suture was pulled tightly without excessive tension to reduce the defect area and limit it to a tiny gap (Figure 1C). The total closure of all the defects was ensured following this step. Mild subcutaneous undermining was performed only for defects located opposite to the relaxed tension skin lines to facilitate wound closure without tension. After the closure of the dermal layer with a four quadrant-embedded purse-string suture, two or three interrupted sutures were applied to close the epidermis (Figure 1D). For epidermal closure, we used a polypropylene suture (Demelene, USA) ranging from 6-0 (smallest) to 4-0 (largest) depending on the size of the wound. Polypropylene sutures (Demelene, USA) were removed approximate-

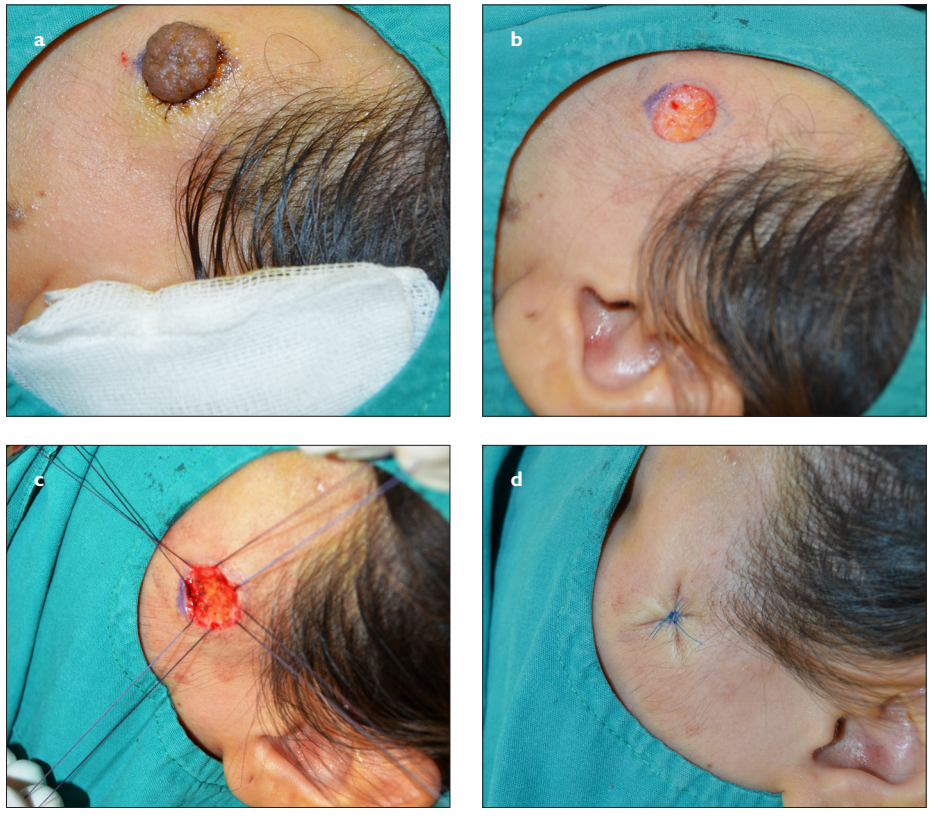

Figure 1. a-d. (a) The tumor is marked as circular, (b) Round defect after resection, (c) Application of four quadrant embedded purse string suture, (d) Final intraoperative appearance after completion of skin suturing

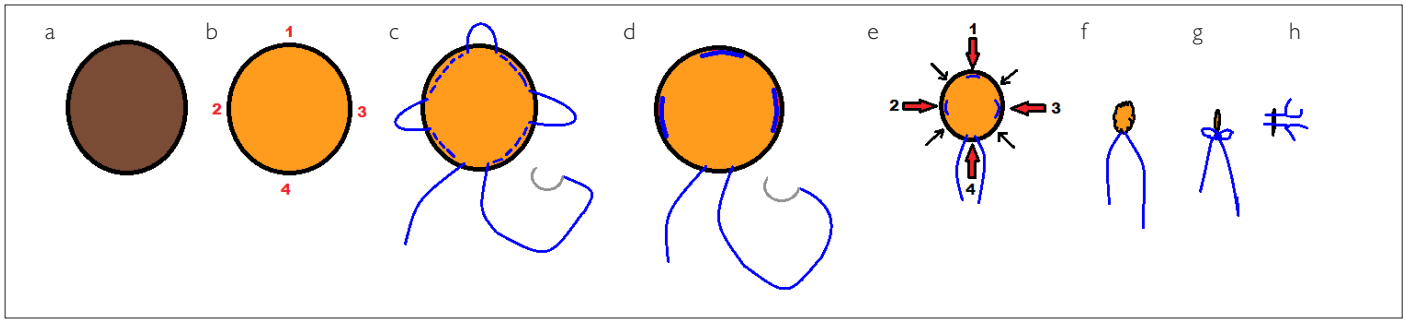

Figure 2. a-h. (a) Circular defect after excision of the lesion, (b) four quadrant is determined, (c) The needle is initially inserted into the dermis in first quadrant and is horizontally advanced about 3 mm within the adjacent dermis before it exits from the dermis in other quadrants, (d) The needle encompasses the all quadrants, (e) Red arrow is main vector small arrow is additional vector, (f) Purse-string of the suture is gently pulled taut and tied, (g) Skin closure, (h) Final appearance

Figure 3 a, b. (a) Benign tumors on nose and malar region, (b) Satisfactory result of the scar at six months following four quadrant embedded purse string closure technique

ly 7-10 days after operation. The scar During was evaluated on sixth month after surgery. A revisional procedure was not required for any of the cases.

Results

The 208 four quadrant–embedded purse-string closures were administered in 143 patients (69 men and 74 women) whose ages were 18-65 (mean: 27.8). The surgical defects, reconstructed with four quadrant–embedded purse-string closures, resulted from tumors located on the cervicofacial region (n=159), trunk (n=40), and the extremities (n=9). Absorbable sutures were used in all four quadrant–embedded purse-string closures. Polydioxanone was used in 126 defects, while polyglactin 910 was used in 82 defects. The thickness of the sutures varied from 6-0 (smallest diameter) to 3-0 (largest diameter). Most frequently used sutures were 4-0 polydioxanone and 5-0 polyglactin 910. Each circular defect post tumor removal was closed completely by four quadrant-embedded purse-string suture technique. The tension of the wound was loaded principally to the embedded purse-string sutures. Two or three polypropylene sutures were then applied for epidermal closure. Most of the surgical defects were caused by the excision of the benign nevi, and the vast majority showed good final healing postoperatively without serious complications (Figure 3). Three patients who showed evidence of infection recovered with oral antibiotic therapy. We observed the loosening of the purse-string suture in two patients who were instructed to apply a topical ointment daily for secondary healing. A hypertrophic scar was observed in one patient who had a lesion on his back. Scars were evaluated according to the POSAS scores. The results were satisfying, with a total score of 17.74 on the Patient Scar Assessment Scale (PSAS, Table 1) and 15.3 on the Observer Scar Assessment Scale (OSAS, Tables 1 and 2).

Discussion

Circular excision and purse-string closure techniques were earlier used for surgical treatment of facial infantile hemangiomas and adult skin lesions [1, 4]. The purse-string closure method, first described by Greenbaum and Radonich, renders obsolete the excision of intact skin surrounding the wound, allowing total closure for small-round skin defects or a reduction of area for wider surgical defects [5].

Circular excision of the lesions, especially on the face, yields several advantages compared to elliptical excision. With purse-string closure methods, the lesion can be converted to a lesser round scar that is more pleasing than a longer linear scar [6]. The efficiency of purse-string suture methods has been proven for the closure of various surgical wounds after the excision of some skin tumors [7]. The purse-string suture method can be used either to decrease the size of the defects or completely close the defects resulting from skin tumors. Nonabsorbable sutures rather than braided sutures are generally more conducive to suture removal. Using monofilament suture materials for purse-string closure provides some advantages, including a decreased tissue drag that allows to easily tighten the purse-string closure and reduce the risk of tissue reactivity resulting in a nidus of infection [7, 8]. The thickness of the placed sutures ranged from 6-0 (thinnest) to 3-0 (thickest); however, we mostly used sutures with smaller diameters (4-0 to 6-0). As few of the polyglactin 910 sutures ruptured when the four quadrant–embedded purse-string suture was being tightened in some initial cases, we mostly preferred using polydioxanone sutures. The optimal duration recommended for the purse-string suture to remain intact varies. Usually it is suggested to remove the purse-string su-

ture typically after 3 or 4 weeks [9, 10]. In this study, absorbable sutures, such as polydioxanone or polyglactin 910 sutures, were used in an embedded fashion. These sutures start losing their tensile strength after approximately 4-5 weeks due to the hydrolyzation. Thus, this period of tensile strength and the lack of the need for suture removal are benefits of the purse-string suture. As the surgical defects in our study were relatively smaller and caused less skin tension, we usually removed the skin sutures approximately after 7-10 days, depending on the wound size and location. Skin suture removal was delayed by a few days to more than a week if the patient had comorbidity that compromised wound healing. The initial appearance of a purse-string suture closure applied to a defect may be unpleasant because of the radial skin folds. Raposio stated that the initial concentric skin folds resulting from purse-string sutures flatten by the fourth week after surgery [11]. Similarly, a four quadrant-embedded purse-string technique also causes radial skin folds and an initial pleated appearance that resolves after a few weeks. This can be probably considered to be the main disadvantage of the four quadrant-embedded purse-string technique, similar to other conventional purse-string closure techniques. However, some of the defects resolve with linear scars that are aesthetically superior to those that result from a layered, side-to-side closure [12]. Final scar appearance is usually acceptable in an embedded purse-string closure technique.

The four quadrant–embedded purse-string suture closure provides additional hemostasis of the wound edges similar to the conventional purse string suture. This method of reconstruction minimizes the number of needle passes required for a closure by ensuring that there are substantial vectors to allow the wound to contract toward the center. There are also some other advantages compared to the conventional purse-string closure technique. The technical aspects of the procedure defined in this study can be very easily learned and the procedure can be performed rapidly.

When a circular wound repaired by a purse-string closure is complicated by infection or dehiscence, the outcome of the scar is not as adversely affected, as in the case of linear closures. This is due to the contraction ability of the round wound with secondary healing similar to a noncomplicated circular closure [13]. We observed infection in three patients, which was treated with oral antibiotics. They did not have any complaints about the final appearance of the scar after a 3-month follow-up. There was no evidence of hypertrophy of the scar, despite prolonged wound healing. In these cases, the main reason that prevented the scar from spreading or becoming hypertrophic may be explained as the ability of the embedded four–quadrant purse-string suture to maintain its strength without loosening and preserve its vectors that contribute to contraction. According to the POSAS scores, a satisfactory assessment of the scars by patients and observers was observed.

Patient assessment of scar color yielded a mean value of 3.12 out of 10, probably reflecting the apparent erythema of the scar. We suppose that erythema will fade with time; however, studies with longer follow-up are required to determine this. The mean scar stiffness score of 3.44 out of 10 can be explained by the fact that a remodeling phase was not completed. Silicone ointment and massage may reduce the stiffness.

POSAS presents a clinical, comprehensive approach to evaluate scars from the perspectives of clinicians and patients. The main value of the POSAS in scar assessment lies in the inclusion of a patient component. The patient's impression of the scar has a remarkable effect on overall scar scoring. POSAS also provides objective patient data over time. Thus, physicians can counsel patients more accurately about how they will perceive their cosmetic results as the scar matures with time [14].

This study has some limitations. First, the follow-up period was up to 6 months in our study. However, the processes of scar maturation and collagen remodeling may last up to 2 years. Hence, longer follow-up periods can provide a more accurate assessment of this technique. Second, although all patients were advised to use silicone ointment and sunscreen for the scar, an absolute scar treatment regimen standardization could not be achieved due to the lack of compliance. Treatment of malignant tumors usually includes additional chemotherapy and radiotherapy, which may cause impaired wound healing. Thus, we found it appropriate to research the efficiency of this technique only in terms of the recovery from the defects resulting from benign lesions.

To conclude, the four quadrant–embedded purse-string skin closure significantly improves outcomes and patient satisfaction compared to the conventional linear skin closure technique. Its learning curve is remarkably short. A four quadrant–embedded purse-string technique is a simple modification of the traditional technique and a very useful method to close skin defects after circular resection of lesions with minimal scarring. With these features, this technique can be considered to be a priority among surgical techniques that can be used for reconstruction following the removal of benign skin tumors or nevi.

Ethics Committee Approval: Ethics committee approval was received for this study from Kahramanmaraş Sütçü İmam University, School of Medicine Ethics Committee on Clinical Trials (15/12.09.2018)

Informed Consent: Informed consent was obtained from patients who participated in this study.

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