INTRODUCTION

Cleft palate fistula is defined as a breakdown in the primary surgical repair of the cleft palate resulting in oronasal communication, which can create symptomatic regurgitation for fluids/solids and affect speech, manifested by airflow escape during phonation. With the reported postoperative occurrence rate of 33–37% post-fistula repair, it remains a challenging problem. The primary aim of this study was to describe our experience in the management of 7 consecutive cases of recalcitrant palatal fistula, all secondary to primary cleft palate repair. Pure cancellous bone graft was harvested in a standard fashion in sufficient quantity based on size of fistula from the iliac crest and was morselized and was kept mixed with the patient’s blood. After flap turnover for nasal closure, the graft was packed over the raw surface on the oral aspect and was secured by placing an oxidized regenerated cellulose sheet fixed to the surrounding mucosa. As per the Papineau technique, no oral closure was performed. Six-month follow-up showed complete epithelization of the oral raw surface in 6 of the 7 patients. In the diverse spectra of cleft surgeries, management of recalcitrant cleft palate fistula remains a surgical challenge. Repurposing Papineau’s concept of open cancellous bone grafting in cleft palate fistula is a novel attempt with a sound scientific basis. In our experience, this technique has proved to be very effective in managing recalcitrant palatal fistulae.

MATERIALS AND METHODS

Research ethics board approval was obtained (UBC REB #H17-00459, and Sir Ganga Ram Hospital Ethics Committee #EC/10/15/913). In the case series being reported, we represent our experience in the management of recalcitrant palatal fistula.

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.
ment of 7 consecutive cases of recalcitrant palatal fistula. We define recalcitrant palatal fistula as recurrent fistula postpalatoplasty, which failed an attempted repair using a traditional technique. All fistulas included were secondary to primary cleft lip and palate repair. The size of fistula was graded as small (1–2 mm), medium (3–5 mm), or large (5 mm or more).

Preoperative workup included photographic record of the fistula and complete blood count including coagulation profile. Indications for surgery included nasal air escape from the fistula and/or symptomatic oronasal regurgitation.

**SURGICAL TECHNIQUE**

Figure 1 illustrates a case with recalcitrant palatal fistula preoperatively. After maintenance of anesthesia and positioning, 2% Xylocaine with epinephrine was infiltrated in the subperiosteal plane over the palate adjacent to the fistula. Mucoperiosteal flaps were raised adjacent to the fistula and turned over to achieve tension-free closure creating the nasal lining.

Five to 7 mL of pure cancellous bone graft was harvested in a standard fashion in sufficient quantity based on size of fistula from the iliac crest, morselized, and was kept mixed with the patient's blood. The graft was then packed over the nasal lining on the oral aspect and was secured by placing an oxidized regenerated cellulose sheet (Surgicel, Ethicon, Somerville, N.J.) fixed to the surrounding mucosa to secure the bone graft (Fig. 2). Hemostasis and graft stability was ensured. As per the Papineau technique, no oral closure was performed. In outpatient follow-up at 2 weeks, the surgicel sheet was not discernible and was essentially absorbed. No patient reported any event of the sheet/bone graft emerging from the repaired fistula. The epithelization was near complete at 3 months and fully complete by 6 months. The bone graft did survive and was covered with a uniform epithelialized surface.

Postoperatively, patients were given a clear liquid diet for 7 days, followed by a soft diet for 2 more weeks. Patients were instructed to avoid habitual contact of the tongue over the operative site, and hygiene was maintained with mouth rinses. Patients were followed up weekly for 1 month, followed by biweekly for 3 months and monthly for 3 months. Figure 3 illustrates a case 6 months postoperatively.

**RESULTS**

In the case series presented, a total of 7 recalcitrant cleft palate fistulas were repaired by the technique described herein. The cases were spread across all age groups from 2 years to 23 years and included only medium and large-sized fistulas. Patients having small fistula were managed by conventional methods and not included in the study. Table 1 describes patient demographics and clinical characteristics.

The 6-month follow-up showed complete epithelization of the oral raw surface in 6 of the 7 cases followed up, which included medium size (n = 2) and large size fistula (n = 5). Although 1 large size fistula did not completely heal, but we observed roughly 80% reduction in size of the fistula. Importantly, this patient had a remarkable improvement in speech and symptomatic nasal regurgitation was reduced. He was referred for speech therapy and did not undergo any additional surgery.

At 6-months follow-up, none of the patients had any pain/gait disturbances owing to bone graft harvest from the iliac crest.

**DISCUSSION**

Although conservative treatment is indicated for asymptomatic cleft palate fistula, the indications for surgical repair relate to the associated symptoms. It has been reported that fistula causing disturbance in speech should undergo early repair, whereas the closure of fistula not associated with speech problems should be delayed, if possible, until completion of orthodontic maxillary arch
expansion and be combined with secondary alveolar bone grafting.

Surgical repair of recalcitrant palatal fistula can be technically difficult, most often due to the paucity of local tissue for closure or excessive scarring in the same area as a result of the previous repair. Several techniques have been described to circumvent these problems, including the use of tongue flaps, buccal myomucosal flaps, mucoperiosteal alveolar ridge tissue, and palatal mucoperiosteal flaps. Many surgeons have proposed a variety of surgical methods for closure of palatal fistula, from local flap to microsurgical repair.

Although these methods may have their advantages in certain cases, most are relatively cumbersome and have been implicated with postoperative risks and problems. Tongue flap requires a 2-staged procedure and causes a degree of airway obstruction and diet inconvenience between the 2 stages, apart from potentially causing a tongue deformity. Although small fistulae can be readily managed by turnover flaps, larger fistulae extending across the alveolus into the buccal sulcus, especially in a scarred palate, makes turnover flaps rigid and with poor blood supply, which can result in flap failure.

A stable repair of palatal fistula requires a 2-layer viable tissue closure. But due to the paucity of tissue, often a 2-layer closure from local flaps is not possible. It is in this light we emphasize and successfully describe the role of cancellous bone graft in managing this complex surgical condition by incorporating the duly established Papineau technique.

In 1973, Papineau suggested the role of open bone grafting in management of chronic infectious conditions of bone, typically chronic osteomyelitis and mal-united fractures in extremity long bone. His concept went against the traditional notion that bone graft should not be attempted even in the circumstances of low-grade infection. The Papineau technique was performed in 3 stages according to the description of Roy-Camille et al. The first stage, which involves excision of the infected tissue, is followed by “open air” grafting using spongy bone. The third stage, involves skin grafting. Modern techniques have modified the skin graft phase to leave the bone graft open. Papineau suggested that the cancellous bone offers tremendous resistance to infection and releases growth factors that promote granulation, which is not the case with a cortical bone graft, which suppurates and gets sequestered.

Cancellous bone has inherent osteogenic, osteoinductive, and osteoconductive properties. It is quickly incorporated and revascularized, usually within 2 weeks. Cancellous bone grafts serve as an osteoconductive substrate to support creeping substitution. Autogenous cancellous bone itself contributes to the resistance against infection when using open grafting techniques. Using

![Fig. 3. Case 1—6-months postoperatively.](image)

Table 1. Patient Demographics and Clinical Characteristics

| Study Patient Number | Age and Sex | Type of Cleft | Primary Palate Repair | No. Attempted Previous Fistula Repairs | Size of Fistula | Location of Fistula | Hypernasality | Regurgitation |
|----------------------|-------------|----------------|-----------------------|----------------------------------------|----------------|---------------------|---------------|--------------|
| 1                    | 22/M        | B/L group III  | VWK                   | 2                                      | Large          | Anterior and posterior | +++          | +            |
| 2                    | 14/F        | B/L group III  | VWK                   | 1                                      | Medium         | Anterior with cleft alveolus | +            | -            |
| 3                    | 23/F        | Right group III| No records            | 1                                      | Medium         | Anterior with cleft alveolus | ++           | -            |
| 4                    | 7/F         | Right group III| VWK                   | 1                                      | Large          | Anterior with cleft alveolus | ++           | +            |
| 5                    | 20/F        | Left group III | VWK                   | 1                                      | Large          | Anterior               | +            | +            |
| 6                    | 22/F        | Left group III | VWK                   | 2                                      | Large          | Anterior               | ++           | +            |
| 7                    | 8/M         | Right group III| VWK                   | 2                                      | Large          | Anterior               | +            | -            |

B/L, bilateral; F, female; M, male; VWK, Veau-Wardill-Kilner type of cleft palate repair; (+), mild; (++), moderate; (+++), severe.
cancellous bone grafts in cleft palate fistula correction fills the bony defect in the cleft with a like tissue which stabilizes the maxillary segments orthodontically, thus preventing secondary facial deformities.

CONCLUSIONS

Although numerous surgeries have been devised and attempted with varying degrees of success in this challenging surgical condition, surgeons still have to innovate surgical methodologies and even principles on a case-to-case basis.

Repurposing the Papineau’s concept of open cancellous bone grafting in cleft palate fistula is a novel technique with a sound scientific basis. Open cancellous bone grafting in palatal fistula in our experience has proved to be very effective in dealing with a large fistula in a previously operated on and scarred palate especially when only a single layer closure could be established. We have achieved a stable correction in recalcitrant cleft palate fistula in 85.7% of patients with this technique and advocate this as an alternate to usage of distant tissue like cheek flap, tongue flap, and complex microsurgical repair for recalcitrant fistula.

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