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Clinical Paper
Trauma

A case-controlled, retrospective, comparative study on the use of biodegradable synthetic polyurethane foam versus polyvinyl acetate sponge after nasal fracture reduction

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Abstract. One of the most frequently used packing materials in closed reduction of a nasal bone fracture is the hydroxylated polyvinyl acetate sponge (PVAS; Merocel®); however this may cause synechia, epistaxis, and pain. Synthetic polyurethane foam (SPF; Nasopore® Forte) has recently been used in septoplasty to prevent synechia or restenosis and haematoma formation. The purpose of this study was to compare the effects of PVAS and SPF on postoperative appearance and discomfort following the reduction of nasal bone fractures. We retrospectively reviewed all patient questionnaires and medical histories, and clinical photographs and computed tomography scans obtained before and after surgery. Outcomes were assessed using the Global Aesthetic Improvement Scale (GAIS) score and visual analogue scale (VAS) scores, which were used to assess discomfort during the 6-month follow-up period. Postoperatively, there was no statistically significant difference in the GAIS for the two packing materials ($P > 0.05$). Postoperative epistaxis was observed at a significantly lower rate in the SPF group than in the PVAS group, whereas anterior rhinorrhea and posterior nasal drip occurred at significantly higher rates following removal of packing in the SPF group ($P < 0.05$). The results of this study suggest that synthetic dissolvable polyurethane may be a reliable alternative material for nasal packing and postoperative management following the reduction of nasal bone fractures.

Keywords: nasal bone fracture; nasal mucosa; nasal surgical procedures.

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The most frequently used packing materials for nasal bone fractures include Furacin, Vaseline gauze, gauze with antibiotics, and the polyvinyl acetate sponge (PVAS; Merocel®).[1–3] These materials can be extremely uncomfortable and can cause nasal stiffness, dry mouth, bad odour, pressure symptoms, and dysphagia until removed. They can also cause bleeding upon removal, adhesion to the nasal mucosa, perforation of the nasal septum, and toxic shock syndrome.[4]

K-wires and silicone silastic sheets can also be used for ventilation and to maintain the reduced nasal bone. Advantages of these are that they can be used for long periods of time to maintain the reduction. However, they can cause complications, including frontal and ethmoidal sinus perforations and mucosal necrosis. They should be designed for the individual preoperative state and so the results of these procedures can be dependent on the surgeon's experience and skill.[5–9]

A biodegradable synthetic polyurethane foam (SPF) has recently been used for endoscopic sinus surgeries and septoplasties.[10,11] SPF has strong initial compressive mechanical properties, and the hydrophilic component facilitates water uptake and rapid fragmentation. The material begins to dissolve within a day. There has recently been a case in which SPF was used for a depressed unilateral nasal bone fracture.[12] However, little is known about the usability and effectiveness of SPF in patients with nasal bone fractures.

The purpose of this study is to investigate the usability of SPF as a nasal packing material for nasal bone fractures, compare this with the more commonly used material, PVAS and evaluate whether SPF could improve the postoperative symptoms associated with other nasal packing materials.

Patients and methods

This retrospective study was granted exemption from institutional review board approval. We conducted a retrospective, case-controlled, comparative study of 122 patients who underwent closed reduction of a nasal fracture at the study hospital from January 2010 to December 2011. We excluded 34 patients who underwent surgery for additional disorders, including nasal septal or facial bone fractures. The remaining patients were divided into two groups based on the packing material used: in group I ($n = 44$), PVAS (Merocel; Medtronic Xomed Surgical Products, Jacksonville, FL, USA) was used as the nasal packing material, and in group II ($n = 44$), SPF (Nasopore® Forte; Polyganics BV, Groningen, The Netherlands) was used.

We retrospectively reviewed all patient questionnaires and medical records, including history, physical examinations, and clinical photographs and computed tomography (CT) scans obtained both before and after surgery.

All patients attended the outpatient clinic on postoperative day 3. Questionnaires on postoperative discomfort included items on the severity of epiphora, pressure around the nose, anterior rhinorrhea, postnasal drip, nasal airway disturbance, and dry mouth. Symptom severity was graded using a visual analogue scale (VAS) from 0 (no symptoms) to 10 (unbearable) to generate a VAS score; this was recorded by the patient.[11,13]

Bleeding after removal of the packing materials was recorded by scoring from 0 = no bleeding, 1 = minimal bleeding (confined to the nasal cavity), 2 = moderate bleeding (bleeding out of the nasal cavity), to 3 = severe bleeding (repacking required). The results of the physical examinations, including the presence of bleeding and the state of the mucosa, were recorded by the surgeon.

Outcomes regarding appearance were assessed by outside observers (two surgeons) using the Global Aesthetic Improvement Scale (GAIS); observers compared the preoperative photographs and photographs taken at 6 months postoperatively.[14] The GAIS was recorded with scores of 1 = worse; 2 = no change; 3 = improved but needs revision surgery; 4 = much improved, helped by revision; and 5 = very much improved, no need for revision. The Stranc classification was also reviewed to check the type of impact based on the preoperative facial appearance and facial bone CT. Postoperative appearance, discomfort, and state of the mucosa, including synechia or restenosis, as determined by rhinoscope, were investigated during the 6-month follow-up period.

Surgical procedures

The nasal packing material was selected by the patient, typically based on the cost of the material as well as the cost of the outpatient visit for removal. Conventional methods were used for reduction of the nasal bone fracture. A PVAS pair, cut into a 2-cm length and coated with ofloxacin ointment, was tightly packed into the superior turbinates equally in both nostrils. External splinting was performed using a thermoplastic material (Aquaplast®; Keosan, Seoul, South Korea) with porous, stretchable tape (Fig. 1). Postoperative management was the same for both groups; however the SPF begins to dissolve spontaneously on postoperative day 1, and the dissolved material can be removed by aseptic gauze change. All patients were taught to change the gauze dressings when discharge occurred, and to use Tantum gargles to prevent pharyngitis due to posterior nasal drip and dry mouth. On postoperative day 3, the PVAS was removed at the outpatient clinic; a remoulded external splint was applied to the patients of both groups when swelling had subsided. The patients applied antibiotic ointment to the nostril mucosa for an additional 2 weeks and wore the external splint for 3 weeks.

Statistical analyses

Statistical analyses were performed by independent *t*-tests and χ^2 tests using SPSS software version 18.0 (SPSS Inc., Chicago, IL, USA). A *P*-value of <0.05 was considered statistically significant.

Results

The age of the study patients ranged from 6 to 60 years (mean 27.2 years), and the male to female ratio was 5.3:1. There were no significant differences in age, sex, or the Stranc classification between groups I and II ($P > 0.05$) (Table 1 and Fig. 2). The GAIS (postoperative nasal appearance) was 4.61 ($\pm$ 0.58) for group I and 4.66 ($\pm$ 0.57) for group II; the difference was not statistically significant. With regard to re-correction of a nasal bone fracture (revisional operation, septoplasty, or corrective rhinoplasty), one patient in group I underwent a septoplasty and one patient in group II underwent a revisional closed reduction. One case in each group had synechia. The case in group I did not require additional surgery due to a lack of symptoms. For the case in group II, the synechia was corrected concomitant with submucosal resection and turbinate surgeries.

No additional treatments were needed except to apply antibiotic ointment to the nasal mucosa in the case of grades 0 and 1 nasal bleeding following removal of the packing material. All grade 2 bleeding was successfully controlled after 10 min of