Use of Fibrin Glue for Open Comminuted Nasal Bone Fractures

Hii-Sun Jeong, MD,* Min-Seon Moon, MD,* Hye-Kyung Lee, MD,† and Keun-Sik Kim, MD*

Abstract: Nasal bone fractures are the most common type of facial fracture. Closed reduction has been used as the standard treatment modality for nasal fractures for many years. In cases of nasal fracture with lacerations at the fracture sites, bioabsorbable/metallic plate or interfraction wire fixation can be used with accurate alignment through the openings created by the lacerations. However, in cases of severe comminuted nasal fractures that are difficult to drill and fix, this type of fixation may not be feasible. We performed in 5 patients open reduction with internal fixation through laceration openings using the biomaterial Greenplast (Greencross Corporation, Seoul, Republic of Korea; human plasma fibrinogen, thrombin, aprotinin, and calcium chloride) under general anesthesia. Both structural and aesthetic outcomes were satisfactory. Open reduction through laceration openings and internal fixation with fibrin glue under general anesthesia may be a simpler and more effective method than those currently in general use for the repair of complicated comminuted open nasal fractures.

Key Words: Comminuted fracture, biocompatible materials, open reduction, general anesthesia

(J Craniofac Surg 2010;21: 75–78)

The nose is located in the center of the face and projects outward. For this reason, it is both aesthetically prominent and particularly susceptible to trauma. Nasal bone fractures are the third most common among all fractures and first among facial bone fractures.1 Most cases are handled with closed reduction and nasal packing because of the relatively minor nature of the injuries.1,2 Nasal fractures accompanied by open wounds are instead often treated with open reduction and internal fixation through the wounds using wires or metallic plates. However, absorbable materials have more recently been used because the use of the aforementioned materials can result in complications.3–5

Accurate reduction with internal fixation is usually difficult to achieve in cases of open comminuted nasal bone fractures. We treated 5 patients with such fractures by open reduction and internal fixation using fibrin glue.

MATERIALS AND METHODS

This retrospective study included 5 patients with open comminuted nasal bone fractures who visited our department between October 2008 and January 2009. All patients had type 2 comminuted nasal fractures as scored by the Stranc and Robertson classification.6 The mean age of the patients was 38.8 years, with 4 male and 1 female patient. Three patients had sustained trauma from blunt injury; 1 was injured in an automobile crash, and 1 was injured in a bicycle crash. One case had an associated nasal septal fracture (Table 1).

Surgical Technique

We used a fibrin glue (Greenplast; Greencross Corporation, Seoul, Republic of Korea) for our procedure. This material consists of aprotinin, calcium chloride, and human plasma fibrinogen and thrombin and has been frequently used for blood coagulation or wound healing. Operation was performed under general anesthesia, and the degree of the comminuted fracture was assessed. With Asch forceps on the inside of the patient’s nose, the reduced fracture fragments were maintained at the correct anatomic location. Then, fibrin glue was applied to the aligned fracture fragments through the open wound. After confirming fixation of the fractured fragments and hardening of the fibrin glue, the operative wound was repaired and both nasal cavities were packed with Multicell (Jireh Medical LLC, Seoul, Republic of Korea), after which Aquaplast (Keosan Trading Company, Seoul, Republic of Korea) was applied as an external nasal splint.

CLINICAL REPORT

Patient 1

A 6-year-old boy presented at our department with an open comminuted nasal fracture sustained in a motor vehicle crash. A type 2 comminuted nasal fracture as scored by the Stranc and Robertson classification was noted through a 2-cm laceration at the root of the nose (Fig. 1). Preoperative computed tomographic (CT) scan of the facial bones confirmed a comminuted fracture of the nasal bones and nasal septum (Fig. 2). Under general anesthesia, the wound was sufficiently irrigated with isotonic sodium chloride and reduction was performed using Asch forceps. With the Asch forceps on the inside of the patient’s nose, fibrin glue was applied to the anatomically reduced fracture fragments. Five days after the operation, the nasal packings were removed and three-dimensional CT was performed to confirm accurate alignment and fixation (Fig. 2).

Patient 2

A 6-year-old boy presented at our department with an open comminuted nasal fracture that occurred in a bicycle crash. A type 2
TABLE 1. Patient Characteristics

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex/Age, y</th>
<th>Injury Mechanism</th>
<th>Type*</th>
<th>Septal Fracture</th>
<th>Fibrin Glue</th>
<th>Anesthesia</th>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male/48</td>
<td>Vehicle crash</td>
<td>2</td>
<td>+</td>
<td>+</td>
<td>General</td>
<td>Saddle nose</td>
</tr>
<tr>
<td>2</td>
<td>Male/6</td>
<td>Vehicle crash</td>
<td>2</td>
<td>−</td>
<td>+</td>
<td>General</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Male/47</td>
<td>Blunt trauma</td>
<td>2</td>
<td>−</td>
<td>+</td>
<td>General</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Male/54</td>
<td>Blunt trauma</td>
<td>2</td>
<td>−</td>
<td>+</td>
<td>General</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>Female/39</td>
<td>Blunt trauma</td>
<td>2</td>
<td>−</td>
<td>+</td>
<td>General</td>
<td>None</td>
</tr>
</tbody>
</table>

*Stranc and Robertson classification.

FIGURE 1. A 46-year-old man injured in an automobile crash. There were lacerations present in the nasal root area. The nasal fracture site was assessed through the laceration openings. A, Open reduction performed by supporting the nasal bone with Asch forceps. B, Appearance after application of fibrin glue.

FIGURE 2. Computed tomographic scans of the facial bone in patient 1. Preoperative axial (A), coronal (C), and three-dimensional views (E): comminuted nasal fracture with septal fracture was observed. Postoperative axial (B), coronal (D), and three-dimensional views (F): septal fracture was not reduced completely that result in a postoperative saddle-nose deformity.
Comminuted nasal fracture as scored by the Stranc and Robertson classification was noted, as well as an approximately 1.5-cm laceration at the fracture site (Fig. 3). A preoperative CT scan of the facial bones revealed a comminuted fracture of the nasal bones. The same procedures as previously mentioned were performed using fibrin glue. Five months after the operation, three-dimensional CT was performed to confirm accurate alignment (Fig. 4).

RESULTS

Our surgical technique was satisfactory in these cases of severe open comminuted nasal bone fractures. Complications including hematoma, severe pain, wound infection, and airway obstruction were not encountered after the operation. The CT scan of the facial bones revealed precise alignment and fixation of the fracture fragments in all the cases. The postoperative results were satisfactory in all the patients except in 1 patient with a saddle-nose deformity (Fig. 5).

DISCUSSION

Nasal bone fractures are the most frequent among facial bone fractures because the nose projects out from the center of the face. In most patients with nasal fractures, displaced fracture fragments are successfully realigned with closed reduction under local anesthesia. However, in patients with severe comminuted nasal fractures accompanied by open wounds, fracture fragments are often realigned with open reduction and internal fixation using interossseous wires or metallic plates through the open wounds. In cases of comminuted nasal fractures, open reduction with internal fixation is recommended because accurate reduction is difficult to achieve by closed reduction, where a surgeon's decisions are guided only by palpation of the fracture segments. Open reduction with internal fixation has the advantages of being accurate and rapid because it allows for direct assessment of the fracture fragments. In addition, nasal deformities after operation can be avoided with open reduction.

When wires or metallic plates are used in patients with open nasal bone fractures, they may be palpable or visible. To solve this problem, absorbable plates have recently been used. However, fixation of plates in cases of complicated comminuted nasal bone fractures such as those found in our patients requires difficult-to-perform drilling after alignment of the fracture fragments plus excessive dissection of soft tissue to create space to work. For these reasons, tissue damage is often inevitable and surgical time may be extended; thus, surgeons must have much surgical experience to achieve good outcomes.

The term tissue glue refers to both biocompatible fibrin glue and nonbiocompatible cyanoacrylate. Although the latter is used in the skin, the bone, and the cartilage because of its strong adhesive power, it induces inflammatory reactions more frequently than the former. Because fibrin glue contains fibrinogen and thrombin, it reacts with calcium chloride and induces coagulation chain reactions within a few seconds, thereby accelerating tissue healing through the production of various growth factors. For this reason, fibrin glue has been widely used as a hemostat or adhesive in the surgical field.

For wound closure, fibrin glue is more helpful in wound healing than suture materials because it increases traction power
and prevents hematoma formation. It has also been used in bone reconstruction surgery, and it has been demonstrated that fibrin glue promotes adherence of soft tissue to the grafted bone and subsequently increases the stability and fixation of the bone in mandible reconstruction. 9,10 In patients such as ours who have type 2 comminuted nasal fractures according to the Stranc and Robertson classification, fibrin glue helps to achieve safe, accurate, and rapid open reduction by avoiding the difficult steps of inserting and affixing plates to bone fragments after extensive dissection of soft tissue to create holes for working with the fragments. It seems likely that the use of fibrin glue will also reduce the problems attendant to relatively long surgical times and surgeons’ inexperience with complicated surgical techniques and aesthetic problems and infections due to implants. In our series of cases, case 1 resulted in a saddle-nose deformity 5 days after surgery. It is conceivable that in this case, the external nose was not sufficiently supported by cartilage because of the associated septal fracture.

In this series, we have not included a control group that had nasal reduction without fibrin glue stabilization. In the future, randomized prospective trial with a cost-utility analysis is necessary to determine if fibrin glue should be used for the average Stranc and Robertson grade 2 nasal fracture.

Controversy exists concerning the best use of anesthesia for the reduction of nasal bone fractures. Many surgeons have proposed that although the method of anesthesia is usually selected based on the surgeon’s experience, local anesthesia is usually preferable because of cost, time required, and ease of procedure. 11–13 Because a relatively longer time, airway maintenance, and pain control are required while fibrin glue sets, we performed a stable and more accurate reduction of nasal bone fractures using general anesthesia.

In conclusion, the use of fibrin glue may be an effective and easy method for treatment of open nasal comminuted fractures.

REFERENCES


FIGURE 5. Preoperative and postoperative views from patient 1. Preoperative frontal (A) and lateral views (B): nasal fractures accompanied by open wounds at the root of the nose. On the fifth postoperative day, nasal packs were removed (C) and a saddle-nose deformity was noted (D).