Prognostic Factors of Survival From Intractable Oronasal Bleeding After Successful Transarterial Embolization

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Purpose: To evaluate the prognostic factors that influence the survival of patients with traumatic intractable oronasal bleeding treated by transarterial embolization (TAE).

Materials and Methods: Patients who received TAE for intractable oronasal bleeding in the National Taiwan University Hospital from 2002 through 2013 were included in the study. Retrospective reviews were undertaken to collect relevant clinical and neuroradiologic data that might be correlated with patients' survival. The Wilcoxon rank-sum test or Fisher exact test was adopted to analyze differences between the survival group and the mortality group. Odds ratios were estimated by univariate logistic regression.

Results: TAE successfully controlled the bleeding in 24 of 26 patients (92.3%) who had severe craniofacial injury in the 12-year period. Of the 24 patients with successful TAE, 13 patients were discharged alive from the hospital. The overall survival rate was 50% (13 of 26). Significantly higher initial Glasgow Coma Scale (GCS) score ($P = .01$) and lower Injury Severity Score (ISS; $P < .01$) were present in the survival group than in the mortality group by the Wilcoxon rank-sum test. Moreover, patients with an ISS of at least 30, a GCS score lower than 9, initial hemoglobin level lower than 10 g/dL, and computed tomographic (CT) findings of a brain midline shift had statistically higher odds ratios predicting mortality than their counterparts as estimated by univariate logistic regression.

Conclusions: The results of this study showed that the combination of diagnostic angiography and therapeutic embolization is effective treatment for intractable oronasal bleeding in patients with severe craniofacial injury. The prognosis in patients who were rescued with successful TAE was statistically correlated with the severity of trauma and concomitant brain injury. An ISS of at least 30, a GCS score lower than 9, an initial hemoglobin level lower than 10, and CT findings of a brain midline shift were strong predictors for mortality.

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Intractable oronasal bleeding is a rare but life-threatening complication compared with the common presentation of severe intracranial hemorrhage after head injury.[1-4] In patients with massive bleeding refractory to conventional therapy, such as manual pressure and nasal packing, the compromised airway and profound shock status often are the major cause of mortality. Percutaneous endovascular treatments, such as transarterial embolization (TAE), have emerged as the rescue choice for intractable nasal bleeding since their successful introduction to intractable epistaxis in emergency or elective cases.[5-7] The

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success rate of TAE in controlling oronasal bleeding is reported at up to 96%, with a major complication rate of approximately 3%.[8,9]

TAE is an alternative to surgical exploration, which is often technically difficult owing to swelling of the neck and face. After identification of the bleeder by diagnostic angiography, the active bleeder is selectively embolized by Gelfoam, glue, microcoils, etc. The advantages of TAE include direct visualization and control of multiple bleeding points, repeatability, and rapidity of deployment.[2]

Although TAE can be used initially to rescue patients from intractable oronasal bleeding, there are patients who do not survive after treatment. In this report, the authors share their TAE experiences for traumatic oronasal bleeding and evaluate the prognostic factors that can influence the survival of these trauma patients.

Materials and Methods

The authors conducted a retrospective study with comprehensive chart reviews to survey the relevant factors. Patients who received TAE for traumatic intractable oronasal bleeding and were admitted to the National Taiwan University Hospital (Taipei, Taiwan) from 2002 through 2013 were included. Owing to the retrospective nature of this study, it was granted an exemption in writing by the National Taiwan University Hospital institutional review board.

Upon arrival at the emergency department, trauma patients were managed according to the guidelines of Advanced Trauma Life Support. An emergency artificial airway was established, if necessary, by intubation, cricothyrotomy, or tracheostomy. Fluid resuscitation was given to restore tissue perfusion. Computed tomographic (CT) scans were performed for patients with head injury or polytrauma to evaluate the extent of injury.

Patients with oronasal bleeding uncontrolled by local manual pressure and nasal packing within the first 2 hours or blood loss estimated at more than 1,500 mL with transient or no response to fluid resuscitation were sent for emergency craniofacial angiography. Diagnostic angiography was performed through a femoral artery approach for evaluation of the common, internal, and external carotid circulations. Once an active arterial bleeder was identified, it was selectively embolized as distally as possible. The authors use Gelfoam sponge, polyvinyl alcohol, contour particles, fibered platinum microcoils, and N-butyl cyanoacrylate glue alone or in combination as embolization material, depending on the site and type of injury. The origin of bleeding owing to maxillofacial trauma is mainly from the external carotid artery, internal maxillary artery, and its intraosseous branches.[7] If angiography visualized hyperemic change in the oozing area, then selective embolization of the vessel accounting for the specific region (eg, pharyngeal artery of the internal maxillary artery) also was performed to achieve complete hemostasis.

Exclusion criteria of the study were patients who had cardiopulmonary arrest or had severe injury that required emergency surgery before craniofacial angiography. There were no absolute contraindications because angiography and TAE can serve as lifesaving procedures. Contraindications included allergy to contrast medium, renal insufficiency, and uncorrectable coagulopathy.

Hospital charts and patients' radiographs were reviewed retrospectively. The authors collected basic demographic data, namely age, gender, injury mechanism, and relevant clinical records, including initial systolic blood pressure, heart rate, hemoglobin level while in the emergency room, Glasgow Coma Scale (GCS) score, Injury Severity Score (ISS), CT and angiographic findings, and hospitalization days.

Continuous variables were presented as mean ± standard deviation, and categorical variables were presented as number and percentage. The Wilcoxon rank-sum test or Fisher exact test was adopted to analyze differences between the survival group and the mortality group. The mortality odds ratio was estimated by univariate logistic regression. All statistical analyses were performed using SAS 9.2 (SAS Institute, Cary, NC). All statistical tests were 2-sided, and P values less than .05 were considered statistically significant.

Results

DEMOGRAPHICS AND CLINICAL CHARACTERISTICS

During the past 12 years, 1,625 patients visited the authors' emergency department for oronasal bleeding. Of these patients, 26 (1.6%) received TAE for traumatic intractable oronasal bleeding that was refractory to conventional therapy. The ISS ranged from 5 to 66 (mean, 33.5 ± 17.00). The mechanisms of injury included motor vehicle accidents (n = 18), falls (n = 7), and penetrating gunshot injury (n = 1).

ANGIOGRAPHIC FINDINGS

Multiple bleeding vessels were found in 30.7% of patients (8 of 26). The bleeding vessels (Table 1) included the internal maxillary artery (31.6%), facial artery (15.9%), lingual artery (15.9%), middle meningeal artery (13.2%), and external carotid artery (7.9%). After diagnostic angiography, TAE failed in 2 patients. A male patient had increased intracranial pressure that led to a slow carotid flow and difficult bleeder identification. A female patient had multiple active arterial bleedings and 2 small-caliber pseudoaneurysms could not be embolized safely. These