INTRODUCTION Pneumosinus dilatans refers to abnormal air-filled expansion of the paranasal sinuses beyond the normal osseous boundaries. Although the etiology remains unknown, multiple theories have been described including outflow tract obstruction with “ball-valve” phenomenon, infection by a gas forming organism, abnormal sinus development, and spontaneous clearance of mucocele contents. Distinction between hypersinus, pneumocelle and pneumosinus dilatans as defined by Urken et al is based on the degree of sinus expansion and thinning of the bony walls (1). Potential complications from pneumosinus dilatans of the frontal sinus include pain, cosmetic deformity and intracranial involvement (2-3). We present a case of pneumosinus dilatans of both cosmetic and functional symptoms.

CASE REPORT A 24 year old otherwise healthy male presented with a 3 year history of gradually worsening outward contouring of his forehead bilaterally with rapid expansion in the past 6 months. The cosmetic appearance of the forehead caused the patient concern. He reported severe, “stabbing” forehead pain during the descent portion of air flights. He additionally had a history of thick rhinorrhea and postnasal drip refractory to medical therapy for sinusitis.

Examination revealed bilateral prominence of the forehead with areas of demarcation consistent with the contours of the frontal sinus (Figures 1A, B). Nasal endoscopy was notable for inflammatory changes of the sinonasal mucosa. CT scan revealed diffuse parasinus inflammatory changes as well as hyper-pneumatization of the frontal sinus bilaterally with outward contouring of the anterior table. A type IV frontal sinus cell (aberrant ethmoid cell completely within the frontal sinus) (ARROW) was noted near the area of the right frontal recess (Figures 2 A-C).

DISCUSSION Pneumosinus dilatans has been described in all of the paranasal sinuses, most commonly the frontal and sphenoid sinus. Potential complications include cosmetic deformity, pain, spread beyond the paranasal sinuses, and disruption of normal sinus physiology. The combination of both physiologic disruption and cosmetic deformity represents a significant challenge in the management of this disorder. A number of interesting findings are noted in this case report. The presence of a type IV cell in combination with the worsening of symptoms with ambient pressure changes may imply that the etiology in this case was mechanical obstruction of the frontal sinus outflow tract. A combination of cranioplasty and obliteration of the frontal sinus were performed to manage these issues. Meticulous attention to removal of the sinonasal mucosa and drilling of the underlying bony expanse is indicated to minimize future mucocele formation. Potential options for obliterating the sinus cavity include the use of a pedicled pericanal flap, autologous fat and bone cement. The vascularity and abundant tissue volume of the pericanal flap were distinct advantages in this case given the size of the cavity. An excellent cosmetic outcome was achieved by a combination of recontouring and insetting the osteoplastic flap in a more natural position. Long-term radiographic surveillance of the frontal sinus is indicated given the concern for delayed mucocele formation.

REFERENCES

SURGERY A bicoronal approach was used to elevate an anteriorly based pericranial flap and to expose the anterior table of the frontal sinus. Outward contouring and thinning of the anterior table was noted grossly. The Brainlab image guidance system based on preoperative CT imaging was used to outline the margins of the anterior table. A bone saw was used to remove the anterior table as a single osteoplastic flap. Hyper-pneumatization of the frontal sinus as well as inflammatory changes of the sinus mucosa were noted. The intersinus partitions including those of the type IV frontal cell were removed and the entire sinus mucosa was systematically removed (Figure 3A-C). The expanses of the bony sinus was polished with various sized diamond drills (Figure 3D). The mucocele of frontal recess was inverted towards the outflow tracts and covered from above with temporalis fascia, bone chips harvested from outer calvarium and tissue sealant. The pedicled pericranial flap was draped into the frontal sinus (Figure 3E). The anterior table was polished, recessed into the frontal sinus and plated with 2 mm titanium miniplates (Figure 3F). The margins of the osteoplastic flap were covered with bone cement. The bicoronal flap was redraped and closed in the standard fashion. The patient additionally underwent endoscopic sinus surgery for the remaining paranasal sinuses for inflammatory chronic sinusitis. The patient was doing well at 6 month follow up with an excellent cosmetic result and no symptoms, including during air flight (Figure 4A, B). A CT scan at this time revealed a stable surgical cavity without evidence of mucocele. At one year follow up, a small area of minimal depression was noted corresponding to the inferior margin of the osteoplastic flap. The patient elected to observe this. Otherwise, the cosmetic and functional outcome continued to be excellent.