Silastic Nasal Septal Splint: A Key Success in the Treatment of Acute Nasal Bone Fractures

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ABSTRACT

Objective: Nasal septal splint post manipulation in acute nasal bone fractures treatment can stabilize the septum in perfect position until healing unites which can provide good esthetic and functional long term end results.
Methods: During October 2008-February 2012, there were 530 nasal bone fracture patients (417 male and 113 female ~ ratio 4: 1) admitted at Prapokklao Hospital, 375 isolated nasal bone fractures cases and 142 cases associated with other facial bone fractures. The total 517 treated cases were treated as closed reduction (359 cases) and open reduction (158 cases). After manipulation, tailor- made silastic sheets were placed along the correct position of the nasal septum as a fixation splint with sutures, left in place for 7- 10 days before removal.
Results: The success in closed reductions for isolated nasal bone fractures was 95.73 % (359 cases of 375 cases) and the success in open reduction was 100% (158 cases), with follow-up between 3 months to 3 years. Most cases had a good result and only 17 cases had post-traumatic deformities (3.29 %). Surgical corrections: 3- septorhinoplasty, 2- closed reduction after repeated trauma, 2- augmented rhinoplasty with calvarial bone graft, were done, and ten cases denied further treatment. Conclusion: Nasal septal splint after treatment with appropriate reduction in acute nasal bone fractures could straighten the nasal septum, providing good esthetic and functional long-term end results.

Keywords: Nasal bone fracture treatment, nasal septal splint

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INTRODUCTION

A nose is a three- walled pyramid separated into two nostrils by a midline septum, which has been shown to provide support to the shape of the nose. Fracture of nasal bones cause nasal deformities which can reduce septal stability, cause septal collapse, cause height loss (telescope), and/or cause nasal bridge droop (saddle nose deformity) (Fig 1). The fracture of the nasal bone is the most common facial bone fracture[1], and the third most commonly fractured bones in the body.[2] The prevalence of this fracture is up to 40-50 % of fractures resulting from facial trauma.[3] It was thought that the fracture of the nasal bone was a minor injury.[4,5] However, the total numbers of the incidence of long term post traumatic complications were high. There have been a fewstudies[3-6] describing the high degree of unfavorable outcomes after nasal bone fracture treatment, and the correction of these complications needs complex handling

Fig 1. Fracture nasal bone causes nasal deformities losing nasal height, nasal bridge drooping, decreased stability, nasal ridge shift to right side, septum collapse and nasal tip deviation.

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procedures,[7,8] such as corrective rhinoplasty or septo-rhinoplasty. It was thought that the nasal bone fracture caused impairment of the anterior cartilaginous septum while sparing the posterior bony septum. However, the experimental fracture usually involved the bony septum[9] especially in high velocity trauma. To get the goal of fracture management is to realign cartilage and skeletal structures to their original positions before the injury. The reconstruction conceptscomprise precise anatomical deformity assessments, good physical examinations, appropriate investigations (Fig 2), anatomical reduction, and stabilization until healing unites together with good soft tissue coverage, to achieve satisfactory results in each case. For nasal fracture treatment, the key to success is straightening the septum in the anatomical position[10], after manipulation, and stabilizing in that position until healing unites to prevent post traumatic nasal deformities.

MATERIALS AND METHODS

There were 1,637 patients with facial fractures treated at Prapokklao Hospital Chantaburi during October 2008 to February 2012. The study was reviewed and approved by the Institutional Ethical Committee of Prapokklao hospital (No.15, November 19, 2012). There were 530 cases of nasal bone fractures, 417 male and 113 female (ratio male: female~ 4: 1). Accepted for surgical interventions were 517cases, comprising of 375 cases of isolated nasal bone fractures and 142 cases of nasal bone fractures associated with others facial bone fractures (frontonasoethmoidal, nasoorbitoethmoidal, and or Le Fort fracture) (Table 1). The common cause was mostly from traffic accidents. They presented to the hospital with epistaxis, difficult breathing, black eyes, and or nasal deformities for isolated nasal bone fracture and other clinical presentations of facial bone fractures. Plain films (lateral nasal bone soft tissue technique and skull film water view) were done for medico-legal necessities and treatment. CT- scan was indicated when intracranial injuries were suspected. Diagnosis was mainly based on physical examinations: tenderness, stepping, crepitation, laceration, nasal airway obstruction, and bright light examination at caudal cartilage and septum. The obvious cosmetic deformities and / or functional impairment of breathing indicated surgical intervention. All cases were done under general anesthesia for both closed reduction and open reduction.

Firstly, all 375 cases of isolated nasal bone fractures were treated with closed reduction. If it failed the nasal bone reduction in the appropriate position at caudal septum (16 cases), then it was changed to open reduction (Table 2). The closed reduction of the nasal bone fracture was started with Asch forceps and Walsham forceps (Fig 3a). With these instruments, satisfactory reduction with correct position began by elevation of the pyramidal complex of nasal bones, straightening the nasal septum at the cephalic part followed by the middle part (quadrangular cartilage) and caudal portion on the maxillary crest. Tailor-made silastic sheets (Fig 3b) maintained the precision position, using synthetic monofilament 3-0 mattress fixation sutures, with anterior border just under the pyramidal complex and caudal end on the maxillary crest, along the vomer groove and the palatal groove, draped on both sides of

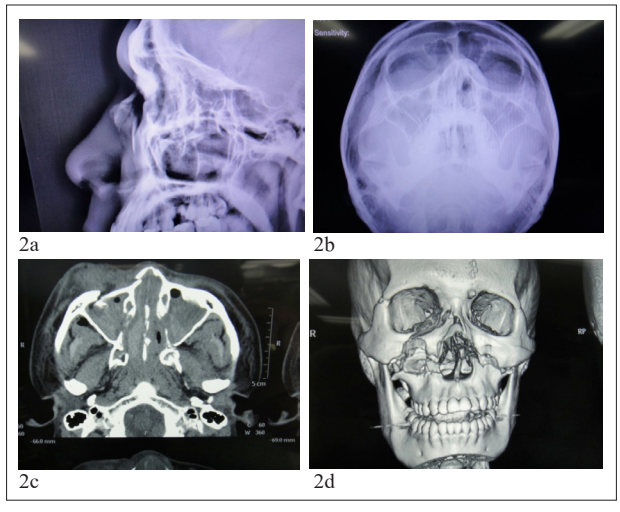

Fig 2. Investigations for nasal bone fracture; lateral nasal bone (2a), skull water's view (2b), CT- brain bone window (2c), and CT facial bone (2d).

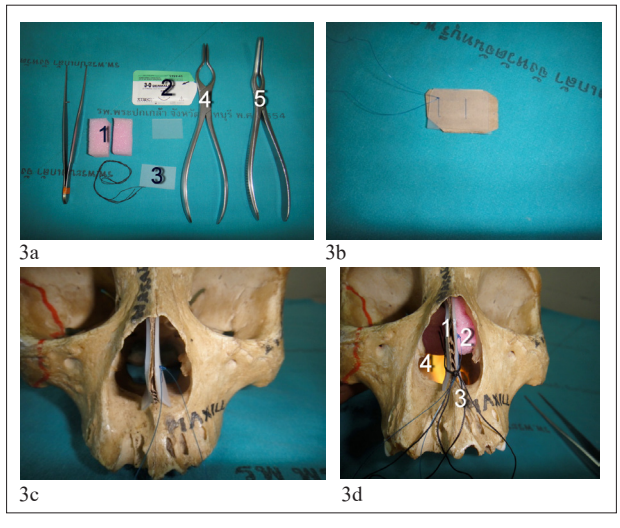

Fig 3. Instruments and technique of nasal septum splint. Instruments (3a): they are sponges (1), suture (2), silastic sheet (3), Walsham forceps (4) and Asche forceps (5). Illustration of matress suture fixation (3b). Relationship between the nasal septum and silastic sheets (3c). Silastic sheets (1) splint on both sides of septum with suturing fixation and sponge packing (2), leaving their tails (3) and sparing caudal nasal airway (4) (3d).

TABLE 1. Patients with nasal bone fracture admitted at Prapokklao hospital during October 2008- February 2012.

Aged Group	0-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51-60 year	>60 years	Total
Male	14	119	117	80	42	24	21	417
Female	2	30	31	18	16	9	7	113
Total	16	149	148	98	58	33	28	530

TABLE 2. Numbers of nasal bone fractures treated at Propok-klao hospital during October 2008- February 2012.

	Numbers of success	Numbers of deformities	total
Closed reduction	349	10	359
Open reduction	151	7	158
Total	500	17	517

the septum (Fig 3c). Both sides of the nasal bone were packed with small antibiotic sponges which were used to prevent collapse of comminuted nasal bones. (Fig 3d). Then the external skin was draped with sterile tapes and an aluminum splint. There were open reductions for 158 cases (Table 2), including 16 failed closed reduction cases and 142 fractured nasal bone combined with other facial bones cases. Open reduction was started with standard incisions i.e., reduction of all fractures under direct vision to get good anatomical position. Then, rigid fixation was performed using plate and screw. Small stainless steel wire was used to fix the caudal septum at the maxillary crest, maintaining the precise position of the septum. A nasal septum splint was done as in closed reduction. In all cases, nasal packing sponges were left in nasal cavities for 3-5 days, and silastic septal splints for 7-10 days postoperatively. After removal of all splints, the schedule to follow up in all cases was weekly for the first month,

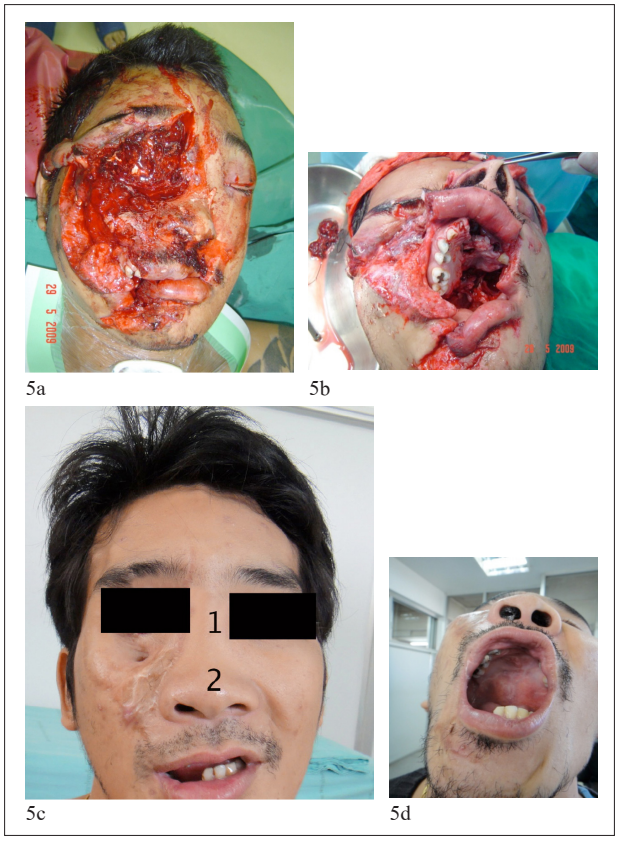

Fig 5. Silastic septum splint in nasal bone fracture associated with other facial bones. Preoperative deformities (5a, 5b): severe displacement and loss of architecture framework. Postoperative appearance (5c, 5d); nasal ridge straightening (1), and good nasal tip projection (2).

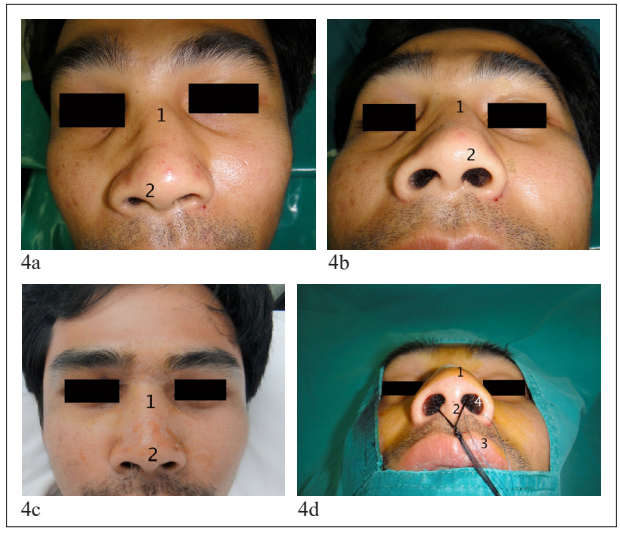

Fig 4. Closed reductions with silastic septum splint for isolated nasal bone fracture. Preoperative deformities (4a,4b); nasal ridge drooping and deviation(1), nasal tip deviation(2). Postoperative appearance (4c): good nasal ridge projection and straightening (1) with nasal tip projection (2). Immediate postoperative appearance (4d): good nasal tip projection (1), straighten nasal columella and septum (2), tail of sutures (3), and patent caudal nasal airway (4).

alternative week for the second month, a month for the third month, and the longest case for three years.

RESULTS

There were 359 successful closed reductions from 375 cases of all isolated nasal bone fractures (95.73%). Regarding open reduction, there were 100 % successful operations (158 cases) (Table 2). There were 9 cases who did not follow our advice and referred themselves to other hospitals. Four cases died from severe head injury (Table 1). Patients who accepted surgery had an elapsed time from injuries to treatment within 7 days for 426 cases (82.40 %) and within 14 days for 501 cases (96.91%). At follow up attention was paid to the history of breathing, evaluation of nasal patency, and nasal contour using bright light examination and photographic record. During the follow up, most cases had normal breathing, straight noses, good contour of pyramidal complex, and good projection of the nasal bridge with triangular nasal bases (Fig 4, Fig 5). Some cases developed post-traumatic deformity complications, due to severe injuries and bone loss (17 cases, 3.29 %) (Table 3). Ten cases had post-operative complications after closed reduction. Two cases that had deformities within two weeks after surgery from

TABLE 3. Post-traumatic deformities and their managements.

	Post-Closed Reduction	Post-Open Reduction	Total
Closed reduction	2	0	2
Septorhinoplasty	1	2	3
Augmented Rhinoplasty	0	2	2
Accepted Deformity	7	3	10
Total	10	7	17

repeated trauma were solved by closed reduction. One case developed partial airway obstruction from a deviated septum that needed correction with a septorhinoplasty operation. Seven cases with minimal deformities after closed reduction denied further treatment. After open reduction, there were seven cases with postoperative complications which included two cases with a deviated septum corrected by septorhinoplasty, two cases with a saddle nose deformity corrected by augmented rhinoplasty with calvarial bone graft, and three cases with minimal post-operative deformities denied further treatment.

DISCUSSION

The main criteria for surgery in the nasal bone fractures consists of the obvious presence of or risk of subsequent cosmetic deformities and functional impairment. That impairment is not primarily caused by intranasal swelling or retained blood clot. The primary goal in the management of the nasal bone fracture is to establish premorbid function and cosmetic appearance of the nose. The factors that contribute to sub optimal functional and cosmetic end results comprise of elapsed timed of trauma, edema, undetected pre-existing nasal deformities and occult from the septum injury. Meticulous physical examination can provide identification of the nasal bone fracture with the septum injury, using bright light endoscope. Plain film lateral nasal bone or water view may serve to guide treatment, and it can provide a legal documentation of injury.[11] CT-scan gives high accurate diagnosis, but it is not necessary in the nasal bone fracture treatment. It does serve to confirm the presence of injury to adjacent bones, such as maxilla and orbits, and the identification of the exact pattern of the nasal septum fracture, which may be somewhat obscured by heavy swelling. CT-scan is routinely used for identification in the evaluation of intracranial injury or adjacent facial bones involvement. Some surgeons suggested using high resolution ultrasound[12,13] for preoperative or intraoperative assessment. This concept is reasonable, but it is invalid. (Do you need an explanation / reason here?)

The treatments of the acute nasal bone are two types, a closed reduction and an open reduction to establish premorbid function and cosmetic appearance of the nose. To achieve the goals of fracture treatment needs an accurate diagnosis, an anatomical reduction and stabilization until bone healing union. Normally it is hard to identify the accurate bony pattern of the nasal bone fracture with general practices, physical examination and plain film investigation. Gunter and Rohrich[10] emphasized the septum as the key structure to align in order to optimize nasal fracture management and to minimize the potential for secondary deformities. Verwoerd[5] and Wexler[8] demonstrated that the septum does not remain straight after manipulation and that nasal bones tend to unite in the direction of the deviated nose. Lee et al[14] demonstrated the fracture pattern of the nasal septum was based on the force applied on the nose. Rhee et al[9] reported their operative findings in patients undergoing treatment for uncomplicated nasal bone fracture. Their observations were made through a hemitransfixation incision at the time of surgery. There were 96 percent of patients found to have a coexisting septal fracture. Deviation of the distal nasal septum has also been shown to affect the position of the lower lateral cartilage, leading to nasal tip deformities if not properly addressed.[10]

Septal splint in the acute nasal bone fracture can help to stabilize the septum in accurate position until bone healing union. The accurate position of the healed septum provides good functions which include patent nasal airways, good adherence of soft tissues to the bony and cartilaginous skeletons[15], and cosmetic end results. There are two types of intranasal splint, septal splint (silastic sheets, suturing, etcetera) and packing. The Doyle splint, a commercial intranasal splint, can provide internal septal splint stabilization with airway maintenance and prevention of synechiae. Packing alone is now used less frequently than in the past. With packing it is hard to stabilize the post-reduction fracture in a proper position. Packing has been shown to be directly associated with postoperative pain, discomfort, soft palate laceration, septal perforation, nasopharyngeal reflex (a life-threatening vagal response that can lead to hypoxia and brady cardia), and even toxic shock.[16,17] Regardless of types of reductions of nasal fracture via both open and closed reduction, after manipulation the fractured nose should be splinted postoperatively, with external and intranasal splints.[18,19]

From this study, a silastic septal splint with small nasal packing improves postoperative cosmetic and functional end results for acute nasal bone fracture management in both closed and open reduction. However, there were a few cases which had posttraumatic deformities (17 cases, 3.29%). Mattress suture fixation at the caudal end of the silastic sheets improves straightening of the caudal end of the nasal septum and tip projection of the nose. Small sponges at the cephalic end of the silastic sheets beneath the comminuted bony fracture portion prevent divergence of both sheets from small bulging at the osteocartilaginous junction of the nasal septum. The sponges provide secured stabilization at the cephalic ends of the silastic sheets. This technique gives lower inhalation airway patency and the patient can breathe through the opening caudal to the sponges. It permits an equalization of the pressure in the nasopharynx during the act of the swallowing and prevents the discomfort of the negative pressure in the middle ear.

CONCLUSION

Silastic nasal septal splint and small sponges packing, after anatomical fracture nasal bone reduction, could help to stabilize the septum in an accurate position until fracture healing union. This technique can provide the good functional and esthetic end results. Compared to sophisticated investigations such as CT-scan, high resolution ultrasonography, intraoperative endoscopic assisted examination or reduction, and silastic nasal septal splint are much more valid.

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