

## RECONSTRUCTION OF NOE FRACTURE WITH IMMEDIATE DICED COSTAL CARTILAGE GRAFTING: A CASE SERIES

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### ABSTRACT

**Background** : Naso-orbital-ethmoid (NOE) fracture is one of the common injury and the management remains difficult and controversial due to the anatomic complexity. Severe facial deformity and dysfunction are the results from the untreated injury. Moreover, the results from many procedures are not aesthetically satisfying. Meanwhile diced cartilage graft popularity is increasing in order to correct nasal deformity whether post trauma, revision (secondary) rhinoplasty or cleft nose. The procedure is less time consuming, easy to perform and also highly malleable.

**Methods** : This study presents our experience in managing four patients with NOE fracture using costal cartilage graft technique immediately after injury. A columellar V-shaped incision was made, the finely diced cartilage harvested from the eighth rib was injected to the glabella, dorsum and nasal tip using one cc syringe needle with cut tip. Demographic data were obtained from the patients' medical record. Post-operative results were observed.

**Result**: The four surgeries were done, with average 5.75 (range, 2-9) days after injury. During the observation, nasal tip misalignment was observed in only one patient. Diced cartilage were not visible through the skin, although it could be palpable. No cartilage extrusion were occurred. After average follow up 10.25 mo (range 8-12 mo) All patients were satisfied with their facial appearance

**Conclusion**: The fracture of NOE can be manage with immediate diced costal cartilage graft, since this treatment can achieve a normal facial function and appearance. The complications are low and manageable, making it as serious contender technique of choice in managing NOE fracture to other techniques.

**Keywords**: NOE fracture, diced costal cartilage graft, facial fracture

**Latar Belakang**: Fraktur Naso-orbital-ethmoid (NOE) adalah fraktur yang umum terjadi dan penatalaksaaannya cukup sulit serta masih menjadi perdebatan dikarenakan kompleksitas anatomi pada daerah tersebut. Deformitas wajah dan disfungsi dapat terjadi akibat kerusakan pada area ini. Terlebih, menurut kami beberapa penatalaksanaan masih belum memuaskan. Sementara cangkok potongan kartilago iga secara langsung semakin populer digunakan untuk mengatasi deformitas pascatrauma, revisi (sekunder) rhinoplasty dan sumbing hidung. Cangkok potongan kartilago iga lebih cepat dan mudah untuk dilakukan dan mudah dibentuk.

**Metodologi** : Studi ini melaporkan tatalaksana empat pasien dengan fraktur NOE menggunakan cangkok potongan kartilago kosta. Insisi berbentuk V pada kolumela dibuat, potongan kartilago diambil dari tulang rawan rusuk ke delapan yang telah dihaluskan lalu disuntikan ke glabella, dorsum dan nasal tip menggunakan suntikan satu cc yang ujungnya telah ditumpulkan. Data demografis diambil dari rekam medis dan hasil pascaoperasi dievaluasi.

**Hasil**: Sebanyak empat operasi dilakukan dalam rerata 5.75 (kisaran, 2-9) hari setelah terjadi trauma. Selama observasi, terjadi kondisi puncak hidung yang tidak sejajar pada satu pasien. Potongan kartilago iga tidak tampak pada kulit namun dapat diraba. Tidak ada penonjolan tulang yang terjadi. Semua pasien merasa puas terhadap tampilan hasil operasi.

**Kesimpulan**: fraktur NOE dapat ditatalaksana dengan cangkok potongan kartilago kosta, untuk memperbaiki fungsi dan estetik. Komplikasi yang muncul sedikit dan mudah untuk diatasi sehingga membuat prosedur ini menjadi penantang untuk tatalaksana fraktur NOE dibanding prosedur lain.

**Keywords**: NOE fracture, diced costal cartilage graft, facial fracture

Received: 15 November 2017, Revised: 17 Desember 2018, Accepted: 21 Desember 2018

ISSN 2089-6492 ; E-ISSN 2089-9734  
This Article can be viewed at [www.jpjournal.com](http://www.jpjournal.com)

## INTRODUCTION

Naso-orbital-ethmoid (NOE) fracture is common and the managements are difficult to discuss and still debatable due to the complex anatomy in this region. If any structure damaged, it is quite likely to result in abnormal both facial appearance and function. Diced cartilage firstly introduced by Peer in 1943, to reconstruct skull defect, ear, fill depressions over the malar bone and elevate a depressed floor of the bony orbit. After this technique has been abandoned for years, it has gained its popularity back again since the “Turkish delight” technique popularized by Erol<sup>1</sup> who wrapped the diced cartilage with absorbable Surgicel (Ethicon, Inc., Somerville, N.J.) for those with primary rhinoplasty, postrhinoplasty deformity, and traumatic nasal deformity. Guerrerosantos also used this technique with fascia graft to wrap the diced cartilage<sup>2</sup>. Our center hvbeen using diced costal cartilage technique without cartilage “Sleeve”<sup>3</sup> to correct the nasal deformity of NOE fracture patients. The purpose of this study is to describe our technique using diced rib cartilage to correct immediately the naso frontal appearance and projection for primary reconstruction in NOE fracture patients which is never described before in any literature.

## PATIENTS and METHOD

This technique was performed on four male patients from July of 2017 to November of 2017. All those patients come to emergency room after motorcycle traffic accident and diagnosed as NOE fracture. The surgery performed immediately (<14 days after the trauma).

Patients were evaluated with preoperative and postoperative photographs. Patients were followed up for a period of 8 months to 1 year.

### Surgical Technique

#### Preparing Diced Cartilage

The eight rib cartilage was harvested and prepared for injection (Fig.1 A). The outline on the rib was marked with sterile surgical marking pen. An incision was made along this line and deepened up to the perichondrium. The cartilage harvested by separating it from underlying perichondrium. Once cartilage harvested (Fig.1 B), the perichondrium was stitched again. Then, the cartilage was diced into small pieces (diced cartilage 1-mm cubes) with a #15 surgical blade and soaked in a solution of Gentamycin sulfate diluted in 250 to 500 mL of NaCl 0.9%. A gauze-covered suction tip was used to fill 1-CC syringes with diced cartilage (Fig.1 C)

#### Making a Pocket and Diced Cartilage Insertion

A columellar V-shaped or stair-step incision was made. A midline pocket is dissected from the nasal tip to the glabella, while making sure the dissected area keep on supraperichondrial and subperiosteal. Careful note was taken to make sure the pocket are closed and tight to prevent our diced cartilage misplaced and perfect contouring could be achieved.

Once the closed pocket was made, the diced cartilage were filled into the glabella, dorsum, tip, and infratip lobule (depends on the deformity).

**Based on author experience seven mL of diced cartilage were adequate for the procedure.**



**Figure 1.** Cartilage harvesting and preparation. A: The design of 8<sup>th</sup> rib cartilage harvesting is marked with sterile surgical marking pen. B: Rib cartilage is ready to be diced. C: 7 ml diced cartilage ready for injection

**Disclosure:** *The authors have no financial interest to disclose.*

**RESULT**

Total four patients were male and performed the surgery immediately, with average 5.75 (range, 2-9) days since the trauma occurred. None of the patients come with NOE type III. The mean age was 32.5 (range, 21-51) years. The mean length of stay was 8.75 (range 5-11) days. The mean follow-up period was 10.25 (range 8-12) months. During the observation, nasal tip misalignment has been observed in one patient while the others was uneventful. Diced cartilage were not visible through the skin, but could be palpable. No cartilage extrusion occurred. All patients were satisfied with their facial appearance. All the demographic, complication and outcome data can be seen on Table 1

**Table 1.** Patient demographic, complication, and outcome data

Case	Sex	Age (yr)	NOE Fr.Type	Days to surgery	LOS (days)	Over-correction / Under-correction	Complications	Follow-up Period (mo)	Patient's satisfaction	Concomitant trauma
1	Male	21	II	7	11	No	None	8	Yes	Fr le Fort 1, le Fort 2, ZMC bilateral, Fr NOE type 2
2	Male	22	I	9	11	No	None	10	Yes	Fr NOE bilateral tipe 1
3	Male	36	II	2	5	No	Nasal tip misalignment	12	Yes	Fr le Fort 2, Fr sagittal palatum
4	Male	51	II	5	8	No	None	11	Yes	Fr tetrapod zygoma dextra, Fr ZMC sinistra, Fr NOE tipe 2

\*LOS: Length of Stay

**CASE 1**



**Figure 2.** (A) postoperative photograph.

CASE 2



Figure 3. (A) preoperative photograph,(B) postoperative photograph.

CASE 3



Figure 4. (A) preoperative photograph,(B) postoperative photograph.

## CASE 3



Figure 5. (A) preoperative photograph, (B) postoperative photograph.

## DISCUSSION

The most common NOE fracture classification used was established by Markowitz and Manson.<sup>4</sup> They divided NOE fractures into 3 types, based on whether the medial canthal tendons attached the central fragment. For type I injury, the medial canthal tendon (MCT) attaches a single-segment central fragment. For type II injury, the central fragment is comminuted, with the medial canthal tendon (MCT) attached. For type III injury, the medial canthal tendon (MCT) is separated with the comminuted central fragment. In our cases there were no type III NOE fracture. Immediate surgery (< 14 days since the trauma) compared to other study that was took more than 2 weeks, produced better outcome.<sup>5,6</sup>

Despite from another literature said that the cartilage framework provides a symmetrical nasal base and helps with tip projection<sup>6</sup>, we did not use any of solid cartilage but finely diced cartilage. It is because our patients did not present with columella, nasal tip and alar deformity.

Previous study used a "sleeve" to wrap these diced cartilage, either using fascia or Surgicel (Ethicon, Inc., Somerville, N.J.), we did not use any of these materials because it was more difficult to predict the amount of diced cartilage needed to filled the defect. It is easier to predict over-correction or under-correction since the graft remains mobile for almost 2

– 3 weeks<sup>7,8</sup>. Baser<sup>6</sup> used fascia lata graft to wrap the diced cartilage reported that diced cartilage extrusion and step-deformity may present and need revision surgery with no further patient's complain. Based on our opinion it was because over-correction or under-correction. Moreover, although the cartilage cubes are sometimes palpable, they are very rarely seen through the skin<sup>3</sup>.

In this procedure we choose to obtain and harvest rib cartilage instead of conchal or septal cartilage. Despite the complication (big scar, pneumothorax or persistent pain); rib cartilage allows us to fill larger defect compared to conchal and septal cartilage.

This procedure is safe, since the cartilages are autogenous, it prevent rejection from the body. Erol stated that there was no infection occurred from total 3125 patients underwent diced cartilage graft<sup>7</sup> during 12-years period. All of our patients had no infection occurred. It was complete opposite when using synthetic implant, it may lead to implant infection or protusion, as Romo<sup>9</sup> reported in his study with 18 patients with cleft nose; one (6%) patient had an infection 6 months after the procedure that required intravenous antibiotics and implant removal. The soft tissue in radix area is very thin, if the infection occurred, it might complicate further revision surgery since the soft tissue there remains little. All four patient were satisfied with the postoperative result

## INTRODUCTION

NOE fracture can be managed properly with immediate diced costal cartilage graft, since the goals of this treatment are to achieve a normal facial function and appearance. The technique relatively easy and the complications are low and easy to manage, making it as a serious contender technique of choice in managing NOE fracture to other techniques.

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