

**MINISTRY OF EDUCATION
AND TRAINING**

MINISTRY OF DEFENSE

MILITARY MEDICAL ACADEMY

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**STUDY ON CLINICAL CHARACTERISTICS
AND SURGICAL CORRECTION
OF POSTTRAUMATIC DEVIATED NOSE**

Major: Plastic, Reconstructive and Aesthetic Surgery

Item No.: 9 72 01 19

SUMMARY OF DOCTOR OF MEDICINE THESIS

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THE PROJECT WAS COMPLETED AT THE MILITARY
MEDICAL ACADEMY

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The thesis will be defended before the university-level thesis
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The thesis can be found at:

1. National Library
2. Military Medical Academy Library

LIST OF PUBLISHED WORKS
RESEARCH RESULTS OF THE THESIS

1. **Nguyen Anh Tuan, Le Tran Quang Minh, Vu Quang Vinh** (2024). “Study on the clinical characteristics and rhinomanometry of patients with post-traumatic crooked nose”, *Journal of Military Pharmaco-Medicine*, 47(8): 173-181.
2. **Nguyen Anh Tuan, Nguyen Xuan Khai, Le Tran Quang Minh, Vu Quang Vinh** (2024). “Study the computed tomography characteristics of the crooked”, *Vietnam Medical Journal*, 542(1): 311-314.
3. **Nguyen Anh Tuan, Le Tran Quang Minh, Vu Quang Vinh** (2024). “Study on the results of post-traumatic crooked nose plastic surgery”, *Vietnam Medical Journal*, 541(2): 355-358.

INTRODUCTION

Deviated nose (DN) affects function and facial aesthetics. The causes of DN are congenital or acquired, of which posttraumatic causes account for the highest rate. Surgery aims to achieve both aesthetics and function. Therefore, it requires surgeons to have a good understanding of nasal anatomy and physiology, accurate diagnosis before and during surgery, as well as knowledge and skills to perform surgical techniques well. Regarding surgery, there are many studies in the world with highly successful treatment results. In Vietnam, there are currently several studies on surgical correction of patients with posttraumatic deviated nose. Studies show good results in aesthetics and fewer complications. However, the reports do not or do not clearly state the techniques for septoplasty and do not objectively evaluate the results of the function. Stemming from the above practical requirements, we conducted the project **"Study on clinical characteristics and surgical correction of posttraumatic deviated nose"** with two objectives as follows:

- 1. To investigate the clinical and subclinical characteristics of patients with posttraumatic deviated nose*
- 2. To evaluate the effectiveness of surgical correction of posttraumatic deviated nose in terms of function and aesthetics.*

NEW CONTRIBUTIONS OF THE THESIS

In this study, surgical correction of patients with posttraumatic deviated nose included the following stages: open approach; Correction of the nasal bone; Septoplasty using the spreader graft and batten graft technique; Dorsal augmentation by autologous rib cartilage grafts and treatment to reduce the volume of the inferior turbinate by out fracture and submucosal of the inferior turbinate, contributing to creating a straighter nasal pyramid, while improving function to help patients breathe more easily.

THESIS STRUCTURE

The thesis consists of 114 pages (excluding references and appendices), 4 chapters, 43 tables, 4 charts, 40 figures, and 1 diagram, 125 references, including 16 Vietnamese documents and 109 English documents. Question: 2 pages, document overview: 26 pages, research objects and methods: 25 pages, research results: 27 pages, discussion: 31 pages, conclusion: 2 pages, recommendation: 1 page.

CHAPTER 1 - OVERVIEW

1.1. Anatomy and physiological function of the nose

1.1.1. Nose anatomy

The nose is divided into 3 parts: the external nose is in the form of a pyramid, also known as the nasal pyramid, the internal nose, and the sinuses next to the nose. The nasal pyramid consists of 3 main parts: the skeleton - nasal cartilage; the outside is covered by skin, mucosa, fat, muscle and connective tissue. The parts that make up the nasal pyramid arch include nasal bones, upper lateral cartilages and lower lateral cartilages. The parts that make up the nasal septum include bone (the perpendicular plate of ethmoid bone, crista galli, the cribriform and vomer) and septal cartilage.

1.1.2. Nose function

The nose has the most important function of respiration, in addition to the function of smelling, resonating and toning the voice and the protective function.

1.2. Definition, causes and classification of deviated nose

1.2.1. Definition: A deviated nose is a common problem among patients for both functional and esthetic reasons. This term encompasses all clinical conditions involving deviation of the nasal pyramid from the midline of the face.

1.2.2. Causes of Nasal Deviation: The DN may be congenital or acquired. Of these, secondary DN after previous trauma is the most common

1.2.3. Classification of the deviated nose: DN, according to Jang Y. J., is applied by many surgeons because it simplifies the analysis of abnormal nasal structures before surgery and surgical planning. The nasal deviations are classified into 5 types on the basis of the orientation of each subunit with respect to the facial midline:

1.3. The posttraumatic deviated nose

Deviated nose sequelae after an injury are defined as a deviated nose after an injury that has not been treated for more than 3 months or a deviated nose after an injury that has been treated with nasal bone correction and the head is ineffective.

1.4. Surgical correction of posttraumatic DN

There are two methods, including rhinoplasty and reconstruction surgery and artistic (camouflaging). Reconstructive plastic surgery is often chosen, including the following stages: Nasal bone reshaping; Nasal septum reshaping; Nasal pyramid reshaping and nasal turbinate volume reduction treatment.

CHAPTER 2 - RESEARCH OBJECTS AND METHODS

2.1. Subjects of study: 40 patients with posttraumatic deviated nose after 3 months or more underwent plastic surgery Ho Chi Minh City Ear, Nose and Throat Hospital 12/ 2020 to 12/2023.

2.1.1. Selection criteria

- DN after at least 3 months of injury
- Patients are indicated for rhinoplasty using autologous rib cartilage
- Patients between the ages of 18 and 60 years
- Complete medical records: diagnostic imaging, pre-operative functional measurements, surgical approval form from the general planning department and hospital board of directors.
- Patient has complete research medical records, post-operative follow-up form.
- Patient agrees to surgery and participates in the study.

2.1.2. Exclusion criteria

- Patients have other respiratory diseases that affect the results of the study.
- Patients with excessive requirements for absolute perfection or suspected psychopathy
- No follow-up, follow-up examination after surgery

2.2. Research methods

2.2.1. Research design: Self-controlled clinical intervention study.

2.2.2. Study sample size

- The study uses the following sample size calculation formula: $n = Z_{1-\frac{\alpha}{2}}^2 \frac{p(1-p)}{d^2}$
- n is the number of patients of the sample to be studied
- $Z_{(1-\alpha/2)} = 1.96$ corresponds to 95% reliability.
- p is rate of functional improvement of patients, we expect to reach 90%, $p = 0.9$.
- d: Absolute accuracy, select $d = 0.10$ (10%).
 $\Rightarrow$ minimum sample size is 35 patients.

2.2.3. Variables collected in the study

2.2.3.1. General characteristics

Age, gender, causes of nasal injuries that cause DN, prehistory.

2.2.3.2. Clinical and subclinical characteristics

- *Symptoms of nasal congestion:* Ask about the disease and NOSE before and after 3 months surgery.

Table 2.1. BN self-assessment questionnaire in the NOSE scale

	<i>Not a problem</i>	<i>very mild problem</i>	<i>moderate problem</i>	<i>fairly bad problem</i>	<i>severe problem</i>
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

- *Types of DN*: according to the Classification of Jang Y. J.
- Condition and degree of nasal septum and inferior turbinate.
- *Clinical α angle measurement*: before and after 3 months surgery
- Measure the angle of the internal nasal valve on the CT before and after 3 months surgery.

- Rhinomanometry before and after 3 months surgery. According to J. Merkle, most healthy, ventilated adults have a for normal total nasal airflow resistance of less than 0.25 Pa/mL/s. Total nasal airflow resistance greater than 0.25 Pa/mL/s often has symptoms of nasal congestion.

2.2.3.3. *Surgical methods*: recording the techniques, materials and morphology of the graft

2.2.3.4. *Evaluation of results*:

- *Postoperative follow-up time*
- *Evaluation of close results*: 2 weeks - 1 month after surgery
- *Nasal congestion with conditions*: no nasal congestion; Nasal congestion improves; Nasal congestion that does not change or gets worse

- *Nose or chest wall incision*: **Good healing**: two edges of the incision are continuous, no fluid accumulation, no redness, no pain; **Not healed**: the two edges of the incision have not been healed, fluid may accumulate; **Infection**: the two edges of the incision have not been continued, may discharge cloudy, swollen, red and painful.

- *Far Result Evaluation*: after surgery 3 months
- *Nasal congestion with conditions*: no nasal congestion; Nasal congestion improves; Nasal congestion that does not change or gets worse

- *Rhinoplasty scar or chest wall scarring*: **Good**: flat and faint healing scar; **Acceptable**: Scar size $\leq 2\text{mm}$; **Bad**: Scar size $> 2\text{mm}$

2.2.3.5. *Evaluation of the effectiveness of surgery*:

- **In terms of function**: Evaluation of improvement of nasal congestion. Based on NOSE, the internal nasal valve angle and

rhinomanometry. Comparison of results before and after surgery 3 months

- **Aesthetics:** Compare the angle α before and after 3 months surgery. The angle α before surgery is α_1 , and after surgery is α_2 .
Result: Good: $\alpha_2 = 0$; **Average:** $0 < \alpha_2 < \alpha_1$; **Fail:** $\alpha_2 \geq \alpha_1$.

- Assessing patient satisfaction: using the ROE (Rhinoplasty outcomes evaluation) checklist by Sara S. E.

2.2.3.6. *Surgical complications*

2.2.4. **Steps:**

2.2.4.1. *Before and after surgery 3 tháng*

- Examination and recording of clinical symptoms:
- For patients to do subclinical procedures such as nasal endoscopy, nasal sinus CT and rhinomanometry measurement.
- Photography: straight, tilt 45° , 90° and nose background.

2.2.4.2. *Surgical methods*

- **Anesthesia method:** endotracheal anesthesia
- **The surgical method** includes the following main tenses
- *Approach:* Open approach surgery technique
- *Correction of bony pyramid*
- *Septoplasty:* Spreader graft and Batten graft techniques
- *Dorsal augmentation and tiplasty:* autologous cartilage implants.
- *Treatment of volume reduction of inferior turbinate:* by submucosal high-frequency bipolar electrocoagulation combined with out fracture of the inferior turbinate
- *Other treatments* (if any): correcting scars; autologous fat and costal cartilage grafting in saddle nose...

2.2.5. Data collection and processing method: based on research medical records and SPSS 22.0 software. Using a t-test paire, the couple averaged the variables before and after the surgery.

2.3. **Research ethics**

- This study is only aimed at improving the effectiveness of treatment for posttraumatic deviated nose

CHAPTER 3 - RESEARCH RESULTS

3.1. General characteristics

Table 3.1. Distribution by age group

Age	Number (n)	Ratio (%)
< 20 years	3	7,5
20-49 years	34	85,0
≥ 50 years	3	7,5

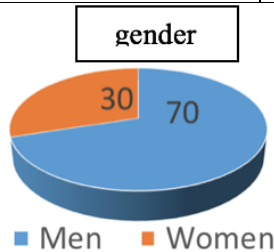


Chart 3.1. Gender distribution

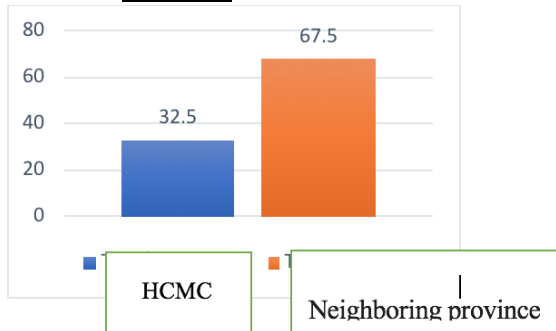


Chart 3.2. Residence

Table 3.2. Causes of injury

Causes	Number (n)	Ratio (%)
Traffic accidents	25	62,5
Fall	6	15,0
Sports	5	12,5
Fighting,	4	10,0

Table 3.3. Etiology

Etiology	Number (n)	Ratio (%)
Functional	19	47,5
Aesthetic	21	52,5

Table 3.4. Prehistory

Prehistory	Number (n)	Ratio (%)
Nasal fractures	40	100,0
Closed reduction of nasal fractures	7	17,5
Other surgery	16	40,0

Table 3.5. Time from injury to admission

Time from injury to admission	Number	Ratio (%)
3 - $\leq$ 6 months	16	40,0
6 - $\leq$ 12 months	10	25,0
$\geq$ 12 months	14	35,0

3.2. Clinical and subclinical characteristics of posttraumatic deviated nose:

Table 3.6. Preoperative functional nasal obstruction

Nasal obstruction	Number	Ratio (%)
Yes	35	87,5
No	5	12,5

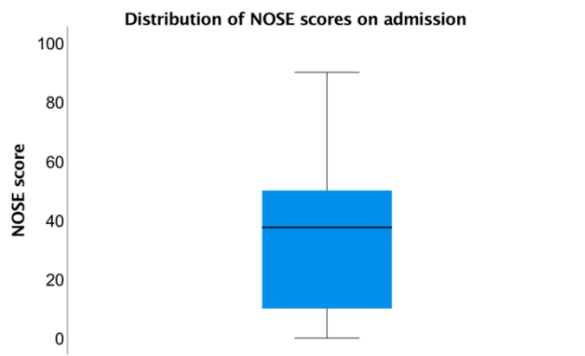


Chart 3.3. Distribution of NOSE scores on admission

Table 3.7. Preoperative α angle

α angle	Mean	Median	P*
Clinic	19,15 $\pm$ 6,88	18,0	> 0,05
CT Scan	17,52 $\pm$ 7,37	16,5	

Table 3.8. Classical of deviated nose Jang Y. J.

Type	Number	Ratio (%)
1	35	87,5
2	5	12,5

Bảng 3.9. Some other clinical characteristics:

Clinical characteristics	Number	Ratio (%)
Saddle nose	8	20,0
Hump	5	12,5
Nose Scar	5	12,5
Facial Asymmetric	17	42,5

Table 3.10. Characteristics of septum preoperative through clinical, CT scan and endoscopy.

Characteristics of septum	Number (n)	Ratio (%)
Non-deviation	1	2,5
Mild, medium-deviation	27	67,5
Severe-deviation	12	30

Table 3.11. Degree of anterior inferior turbinate hypertrophy according to Camacho M.'s classification (appendix 6)

Inferior turbinate hypertrophy	Number (n)	Ratio (%)
Degree 2	1	2,5
Degree 3	39	97,5

Table 3.12. Other facial bone lesions examined by CT scan

Facial bone lesions	Number (n)	Ratio (%)
Septal fracture	27	67,5
Orbital fracture	12	30,0
Sinus fracture	7	17,5
Zygomatic and maxillary fractures	2	5,0
Nasal fracture only	13	32,5

Table 3.13. Preoperative internal nasal valve angle

Internal nasal valve angle	Mean	Median	P*
Right	18,73 ± 7,62	18,5	> 0,05
Left	19,05 ± 6,61	19,5	

3.2.9. Preoperative rhinomanometry

Table 3.14. Preoperative nasal resistance

Nasal resistance	Mean	Median
Left (Pa/cm ³ /sec)	1,30 ± 1,20	0,98
Right (Pa/cm ³ /sec)	0,93 ± 0,58	0,72
Total (Pa/cm ³ /sec)	0,43 ± 0,16	0,39

Table 3.15. Preoperative nasal airflow through the nose

Nasal airflow	Mean	Median
Left (l/sec)	201,53 ± 120,48	159
Right (l/sec)	206,95 ± 118,74	208
Total (l/sec)	394,98 ± 132,13	387

3.3. Surgical results

3.3.1. Specification

3.3.1.1. *Approach*: 100% of cases of open approach.

3.3.1.2. *Correction of bony pyramid*

Table 3.16. Correction of bony pyramid

Technique	Number (n)	Ratio (%)
Osteotomy	32	80
Osteotomy + hum resected	5	12,5
Osteotomy + rasping	3	7,5

Table 3.17. Nasal bone cuts

Technique	One side		Two side	
	n	%	n	%
Medial (n = 40)	7	17,5	33	82,5
Lateral (n = 40)	7	17,5	33	82,5
Intermedian (n = 18)	4	10	14	35

3.3.1.3. Septoplasty

Table 3.18. Septoplasty technique

Technique	Yes		No	
	n	%	n	%
Spreader graft	40	100	0	0
Batten graft	40	100	0	0
Cutting and suturing the caudal septum with the anterior nasal spine.	1	2,5	39	97,5

Material: 100% with autologous rib cartilage.

3.3.1.4. Dorsal augmentation and tiplasty

Table 3.19. Dorsal augmentation

Technique	n	%
rib cartilage	38	95,0
rib cartilage + dermal fat	2	5,0

Table 3.20. Tiplasty

Technique	Number (n)	Ratio (%)
Septal cartilage	39	97,5
Septal cartilage + rib cartilage membrane	1	2,5

3.3.1.5. Treatment to reduce the volume of the inferior turbinate:
100% cases

Table 3.21. Other surgeries

Surgeries	Number (n)	Ratio (%)
Correction scar	5	12,5
Facial fat grafting	2	5,0

3.4. Evaluation of surgical results

3.4.1. Follow-up time after surgery:

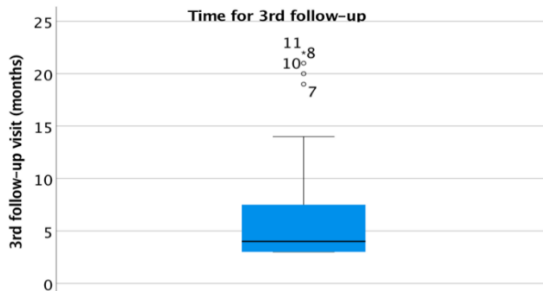


Chart 3.4. Time for 3rd follow-up

3.4.2. Approximate results: 2 weeks and 1 month after surgery

- *Symptoms of nasal congestion:*

Table 3.22. Functional nasal obstruction 2 weeks and 1 month after surgery

Nasal obstruction (n=40)	After 2 weeks		After 1 month	
	n	%	n	%
Absent nasal obstruction	22	55	35	87,5
Improved	16	40,0	5	12,5
More nasal obstruction	2	5,0	0	0

Table 3.23. Condition of the nose pyramid after surgery 2 weeks and 1 month

Nose pyramid	After 2 weeks		After 1 month	
	n	%	n	%
Severe swelling	1	2,5	0	0
Moderate swelling	14	35,0	0	0
Mild swelling	25	62,0	18	45,0
No swelling	0	0	22	55,0
Hematoma	0	0	0	0

- *Nose incision condition:* 100% of the incision heals well after 2 weeks of surgery

Bảng 3.24. Chest wall incision status after 2 weeks and 1 month

Chest wall incision status	After 2 weeks		After 1 month	
	n	%	n	%
well integrated	39	97,5	40	100
seroma	1	2,5	0	0

3.4.3. Distant results: ≥ 3 months after surgery

Table 3.25. Functional nasal obstruction before and after surgery

nasal obstruction (n=40)	Before		≥ 3 months	
	n	%	n	%
Absent nasal obstruction	5	12,5	32	80
Improved	35	87,5	8	20
More nasal obstruction	0	0	0	0

Table 3.26. Condition of the nose pyramid after surgery ≥ 3 months

Nose pyramid	≥ 3 months	
Severe swelling	0	0
moderate swelling	0	0
mild swelling	0	0
No swelling	40	100%

Table 3.27. Nose and chest wall scar ≥ 3 months after surgery

Scar	Good	Acceptable	Keloid
Nose	100%	0	0
chest wall	70%	15%	15%

3.5. Efficacy evaluation after ≥ 3 months of surgery

3.5.1. Functions:

Table 3.28. NOSE score of patients before and after surgery ≥ 3 months

NOSE	Before		After ≥ 3 months	
	n	%	n	%
0	5	12,5	33	82,5
5	1	2,5	2	5,0
10	6	15	3	7,5
15	1	2,5	0	0
20	2	5,0	2	5,0
25	1	2,5	0	0
30	2	5,0	0	0
35	2	5,0	0	0
40	5	12,5	0	0
45	1	2,5	0	0
50	6	15	0	0
60	3	7,7	0	0
65	2	5,0	0	0
70	2	5,0	0	0
90	1	2,5	0	0

Table 3.29. Change in NOSE score before and after surgery ≥ 3 months

NOSE	Before	≥ 3 months	P*
NOSE score	34,01 $\pm$ 23,99	2,01 $\pm$ 5,03	< 0,001

Table 3.30. Changes in internal nasal valve angles before and after surgery ≥ 3 months

Internal nasal valve angle	before	After	P*
Right	18,73 $\pm$ 7,62	33,38 $\pm$ 11,45	< 0,001
Left	19,05 $\pm$ 6,61	34,65 $\pm$ 13,54	< 0,001

Table 3.31. Changes in nasal resistance before and after ≥ 3 months

Nasal resistance	Before	After	P*
Right (Pa/cm ³ /sec)	0,93 $\pm$ 0,58	0,48 $\pm$ 0,25	< 0,001
Left (Pa/cm ³ /sec)	1,30 $\pm$ 1,20	0,46 $\pm$ 0,17	< 0,001
Total (Pa/cm ³ /sec)	0,43 $\pm$ 0,16	0,22 $\pm$ 0,04	< 0,001

Table 3.32. Changes in nasal airflow before and after PT ≥ 3 months

Nasal airflow	Before	After	P*
Right (l/sec)	206,95 $\pm$ 118,74	355,10 $\pm$ 106,70	< 0,001
Left (l/sec)	201,53 $\pm$ 120,48	356,20 $\pm$ 96,16	< 0,001
Total (l/sec)	394,98 $\pm$ 132,13	711,33 $\pm$ 139,55	< 0,001

3.5.2. Aesthetics

Table 3.33. Change the angle α before and after ≥ 3 months

α angle	Before	After	P*
Clinique	19,15 $\pm$ 6,88	0,85 $\pm$ 1,84	<0,001
CT scan	17,52 $\pm$ 7,37	1,15 $\pm$ 1,87	<0,001

Table 3.34. Evaluate the results the angle α before and after ≥ 3 months

Angle α	Good	Acceptable	Failure
Clinical ($^{\circ}$)	33 (82,5%)	7 (17,5%)	0
CT scan ($^{\circ}$)	26 (65%)	35%)	0

Table 3.35. Changes in nasal anthropometric index before and after ≥ 3 months

Nasal anthropometric	Before	After	P*
Angel nasolabial ($^{\circ}$)	92,88 $\pm$ 11,54	94,63 $\pm$ 5,05	0,352
Angel nasofontal ($^{\circ}$)	144,63 $\pm$ 10,46	140,95 $\pm$ 7,97	0,028
Tip height (cm)	1,66 $\pm$ 0,36	1,97 $\pm$ 0,34	<0,001
Nose length (cm)	4,14 $\pm$ 0,47	4,28 $\pm$ 0,41	0,011

Table 3.36. Anthropometric index of nasal tower after surgery ≥ 3 months according to gender

Nasal anthropometric	Men n=28)	Women (n=12)
Angel nasolabial ($^{\circ}$)	94,39 $\pm$ 5,53	95,16 $\pm$ 3,83
Angel nasofontal ($^{\circ}$)	138,92 $\pm$ 7,66	145,66 $\pm$ 6,80
Tip height (cm)	2,01 $\pm$ 0,34	1,88 $\pm$ 0,33
Nose length (cm)	4,36 $\pm$ 0,36	4,09 $\pm$ 0,45

Table 3.37. Patient Satisfaction

Satisfaction	n	%
very satisfied,	23	57,5
satisfied	12	30,0
satisfied but had few defects	5	12,5
unsatisfaction	0	0

Table 3.38. Accidents and complications of surgery

Complications	n	%
Synechia	3	7,5
Seroma	1	2,5
Keloid scar on the chest wall	6	15

CHAPTER 4 - DISCUSSION

4.1. General characteristics

4.1.1. Age and gender

Posttraumatic deviated nose is usually at a young age, with an average age of 33.7 ± 9.89 . This result is generally like other studies

in the country as well as in the world. This is the main working age, participating in many daily social activities with accident risks,

Men account for the majority; the results are like many domestic and foreign authors, such as Bui Tuan Anh; the male/female ratio is 1.8; Kalakuntla M. is 65%: 35%. This is due to the difference in personality between the male and female sexes.

In the study of the causes of traffic accidents, accounting for the majority, 62.5%. This is also reasonable because in Vietnam, where the main means of transportation is motorcycles, it is easy to break the nose bone when in a traffic accident.

4.2. Clinical and subclinical characteristics of posttraumatic deviated nose

4.2.1. Functional nasal congestion

The symptoms of nasal congestion between studies had the same results, accounting for a high rate. According to Foda H. M. J. is 75%, and Cheng L. H. is 88%. The cause of nasal congestion in the posttraumatic deviated nose is physical damage such as septal deformity, internal nasal valve stenosis or hypertrophy inferior turbinate... Therefore, posttraumatic deviated nose, nasal congestion does not respond to medical treatment but requires early surgical intervention, and it is necessary to reconstruct the nasal structure to improve respiratory function.

4.2.2. Classification of deviated nose:

The results of the study of type 1 deviated nose, according to the classification of Jang Y. J., had a high rate (87.5%). This is understandable because our patient is posttraumatic deviated nose, so the mechanism of injury that causes nasal fracture will form deviated nose type 1 (C-shaped deviated nose or Reverse C-shaped). This result is consistent with E. Azizli's study, the rate of C-shaped deviated nose (28%) and Reverse C (21.3%).

4.2.3. Septal characteristics:

100% septal deformity. This result is like the research of other authors. Man K.S. reports that many deviated noses are accompanied

by septal deformity and septal deformity is the most common cause of nasal congestion. Stepnick D. (2010) and C. Ian Newberry (2018) suggest that there is almost always a major septal deformity in a patient with a severely deviated nose.

4.2.4. Hypertrophy inferior turbinates:

The inferior turbinate manages airflow direction and provides the primary resistance to inspired air in the nasal cavity. The inferior turbinate are the structure that makes up the inner nasal valve, which is the section that restricts the airflow of the nasal airway. Therefore, hypertrophy of the inferior turbinate is one of the causes of nasal congestion. In the study, 100% of patients had hypertrophy inferior turbinate, and most of them were grade 3. This is consistent with the results of the study that nasal congestion has a high rate (87.5%). Taek K. K. thinks that most of the deviated nose have a septal deformity, and the hypertrophy inferior turbinate is too much to compensate.

4.2.5. Some other clinical features

Facial asymmetry is the most common deformity in 42.5% deviated nose, similar to the results of Jong S. Y.'s study of 55%. Saddle nose (pseudo- deviated nose) 20%. Different from Bui Tuan Anh's report, this rate is 80%. There is a difference due to the difference in sample selection.

4.3. Surgical Results

4.3.1. Approach

We apply the same open approach technique as many other authors such as Foda H.M., Cheng L.H., Hunsein W.K.,... Findings: The open approach technique has many advantages: clearly observing the entire structure of the nasal area; accurately assessing the structure and degree of damage, thereby accurately selecting the type of graft to be used; at the same time, it can coordinate many types of puzzle pieces and perform easy technical operations. Ensure the best nose rehabilitation and aesthetics. Moreover, this technique does not require complex equipment and can be performed in any medical facility, depending mainly on the qualifications and experience of the surgeon.

4.3.2. Correction of bony pyramid:

Osteotomies (100%), of which 12.5% combined with bony dorsal hum resected, 7.5% combined with the rasping like the method of Kim Y. H.

4.3.3. Septoplasty:

We apply spreader graft technique to straighten the dorsal septum like many other authors Hussein W. K. A., Jang Y. J., Cho G. S., ... It was found that with the open approach, this technique is easy to perform and very effective in correcting 1/3 of the middle of the nasal pyramid while improving breathing function by expanding the internal nasal valve. The caudal septum is the most important structure that supports the nasal pyramid, contributing to breathing function and nasal aesthetics. In this study, we corrected the caudal septum using Batten graft technique, like other authors such as Scott B. R., Rod J. R., Jang J. Y.; Nazim C., Gye S. C.; Wael K.A. H.

Autologous tissue is the most common material in septoplasty because of its high compatibility, non-allergenic and low infection complication rate. Autologous cartilage is septal cartilage, ear cartilage, and septal bone, so it is easy to perform and sometimes autologous rib cartilage. Septal cartilage is taken during septoplasty, but the necessary amount of cartilage is not enough, especially in the case of patients with septal deformity or in case patients have had septoplasty before; it is not feasible to use septal cartilage. Ear cartilage is much more curved and elastic than septal cartilage and rib cartilage, making it unsuitable for supporting nasal structures. Rib cartilage has the advantage of being more abundant, straight, and stable than septal cartilage and ear cartilage. In this study, we used a graft that is autologous rib cartilage. However, the rib cartilage removal technique is a surgery that requires a surgeon to have much experience to limit some complications such as bleeding and pleural perforation; moreover, the patient is in a lot of pain and keloid scars on the chest wall.

4.3.4 Rhinoplasty

❖ **Dorsal augmentation:**

We have dorsal augmentation with rib cartilage for the purpose of covering of the remaining defects after septoplasty and osteotomies, helping to increase the aesthetics of the nose pyramid. Jang Y. J., Jung D. H., and Rohrich R. J. agree with this view

Materials: after septoplasty and osteotomies, the septum and nose lining may be torn, increasing the risk of infection after surgery. Therefore, autologous tissues are a first choice for many surgeons. Commonly used autologous materials such as: septal cartilage, ear cartilage, rib cartilage.... Suh M. K. used autologous cartilage or dermal fat in dorsal augmentation. Bui Tuan Anh use septal cartilage or rib cartilage in dorsal augmentation.

❖ **Correction of tip:**

Like most other authors, such as Bui Mai Anh and Bui Tuan Anh, in our study, we implanted the nasal tip septal cartilage to create nasal tip protrusion and improve the aesthetics of the nose.

4.3.5. Treatment to reduce the volume of the inferior turbinate: to improve breathing function and limit the recurrence of deviated nose.

In the study, we treated 100% of patients with the technique of submucosal high-frequency bipolar electrocoagulation (Coblation) combined with out-fracture of the inferior turbinate, like Jung D. H.'s technique, Suh M. K.'s.

4.4. Evaluation of surgical results

4.4.1. Follow-up time after surgery

In the study, the time for the 3rd follow-up visit was later; the average was 6.73 months, especially in the case of 22 months after surgery. The reason is that the COVID-19 epidemic occurred during the research process. Moreover, due to the psychological characteristics of patients specializing in plastic surgery, when the results are achieved as desired, they do not want to be re-examined.

4.4.2. Evaluation of results: 2 weeks, 1 month and ≥ 3 months after surgery

Functional nasal congestion: In our study, patients with nasal congestion symptoms gradually improved over time due to the gradual

reduction of nasal swelling and oedema. Before surgery, the rate of nasal congestion accounted for 87.5%. After 2 weeks of surgery, we noted that most patients had no congestion or improved their nasal congestion a lot (95%), but 5% of patients had more nasal congestion than before surgery. This is consistent with the clinical progression of the soft tissue of the nose; the nasal cavity is swollen a lot. After 3 months of surgery, 100% of cases of no congestion or nasal congestion are improved. Proving that the results of surgery improve the nasal breathing function of patients. This result is like the reports of many authors, such as Foda H.M. 80% of patients improve their function after SURGERY; Ahmed M. Abu El-Wafa: all patients improve function after surgery.

Surgical scars: 100% good results because this is clean surgery. Moreover, blood vessels of the nose are very rich. Chest wall scarring, 70% good results, 15% acceptable scars and 15% keloids. This result is similar to Jung D. H., the rate of ugly keloid scars on the chest wall is about 10%

4.5. Evaluation of efficacy after surgery

4.5.1. Function: Based on NOSE, the angle of the internal nasal valve and rhinomanometry. Comparison before and after ≥ 3 months surgery:

○ **NOSE Scale**

The average NOSE before and after surgery was 34.01 ± 23.99 and 2.01 ± 5.03 . A statistically significant difference in NOSE score before and after surgery with $p < 0.001$. Proven surgery improves nasal breathing function. This result is like the study of author Aurora G. S. After septoplasty using the spreader graft technique and a reduction in the volume of the inferior turbinate; the average NOSE was significantly reduced compared to before the surgery.

○ **Internal nasal valve angle**

According to Poiseuille's law: ($\text{Flow} = \text{constant } \kappa \times \text{pressure difference} \times r^4 \text{ (radius)/length}$). The airflow through the nose is directly proportional to the square power of the internal nasal valve

radius. Therefore, small changes in the internal nasal valve can also greatly affect the airflow through the nose.

After surgery, the angle of internal the nasal valves on both sides increased and was greater than the average value of normal people in Asia ($21.6^{\circ} \pm 4.50$) and Vietnam (20.25°). The difference in the internal nasal valve angle before and after surgery is statistically significant with a $p < 0.001$. This proves that surgery improves breathing function significantly.

○ **Rhinomanometry:**

After surgery, the total nasal resistance is significantly reduced. The difference was statistically significant with $p < 0.001$. Proven surgery helps improve nasal congestion. The average total airflow through the nose increased significantly compared to before surgery. A statistically significant difference ($p < 0.001$). This proves that surgery helps patients breathe more clearly.

4.5.2. Aesthetics: comparison of α angle before and ≥ 3 months after surgery

After the surgery, the α angle is significantly reduced and is close to 0 (mean $\alpha = 0.85^{\circ}$), meaning that the nose is almost straight. A statistically significant difference ($p < 0.001$). This proves that surgery reduces the deviated nose, making the nasal pyramid straighter. Samuel E.'s research has a high failure rate (14.3%). This difference can be due to many reasons. Firstly, in the surgical plan, the author only performs correction of bony pyramid and septoplasty and does not apply the dorsal rhinoplasty technique to help cover the remaining defects after osteotomies and septoplasty. Secondly, the author did not treatment to reduce the volume of the inferior turbinate to limit the rate of recurrence of deviated nose. Thirdly, the author using ear cartilage or septal cartilage grafts, which in most cases is characterized by the amount of cartilage obtained is small, not straight and often not strong enough, so there is a high possibility of cartilage deformity after surgery, causing recurrent deviated nose. The fourth is the long postoperative follow-up period (18-24 months), so some cases of late recurrence can be recorded.

4.5.3. Patient Satisfaction

After surgery ≥ 3 months, the rate of very satisfied and satisfied patients was high (87,5%), like Lisandra M. A.'s study, where 90% of patients were satisfied; Foda H. M. is 95% satisfied with aesthetics and functionality. However, there is a difference in the rate of patients who have to have surgery again due to mild deviated nose (6%). This difference may be due to a large sample of study authors (260 patients) and a long follow-up period (average follow-up period of 28 months).

4.6. Complications of the technique

The most common complications are keloid scars chest wall, accounting for 15%. The results are like Jung D. H.'s report; the rate of keloid scars on the chest wall is about 10% of cases. The cause is excessive retraction of soft tissue or due to extensive damage to the incision wall due to the manipulation of the incision hole in surgery. To limit the transformation of keloid scars, according to our experience, the skin incision on the chest wall must be wide enough (average 3cm). It is necessary to exercise the edge of the incision before suturing the skin and apply silicone tape to the wound after surgery. The second complication is synechia between the inferior turbinate and septum, accounting for 7.5% (3/40 patients). The synechia occurs because the surface of the nasal mucosa and the septum are damaged in contact with each other. According to Taek K. K. synechia occur at about 5.9% to 36% after surgery. If the adhesion is detected early through clinical examination or nasal endoscopy during the first follow-up visit, the adhesion can be easily separated and the patient will feel a little uncomfortable. When the scar has clearly formed, separating the adhesion will be difficult and sometimes it will be necessary to use local anesthesia or general anesthesia to cut and separate the adhesion. After separating the adhesion, it is necessary to place a suitable soft material (such as Spongel) or place a

thin silicone sheet immediately after separating the adhesion for 1-3 weeks to limit the recurrence of adhesion. In addition, in our study, 1 case (2.5%) seroma of chest was recorded. According to Man K. S., complications of seroma in rib cartilage removal are not common, and drainage is not necessary. Treatment with aspiration of the fluid and compression of the wound.

CONCLUSION

Through 40 cases of surgical correction of posttraumatic deviated nose from 12/2020-12/2023 at Ho Chi Minh City ENT Hospital. We draw some conclusions as follows:

1. Clinical and subclinical characteristics of patients with posttraumatic deviated nose

- Young people are the majority, with an average age of 33.70 ± 9.98 . More men than women (7/3)
- 87.5% of patients had symptoms of nasal congestion of varying degrees.
- Deviated nose type 1 is the main (87.5%).
- 100% of the hypertrophy inferior turbinate and deviated septum.
- Some of the accompanying clinical features are saddle nose (20%), facial asymmetry (42.5%) and bad nasal scarring (12.5%).

2. Effectiveness of surgical correction of posttraumatic deviated

- **Regarding surgery**, all patients are operated on including the following tenses: Open- approach; *Correction of the bony pyramid*: lateral osteotomies and medial osteotomies; *Septoplasty*: Spreader graft and Batten graft techniques using autologous rib cartilage; *Dorsal augmentation using rib cartilage*; correction of tip using septal cartilage; *Treatment of volume reduction of inferior turbinate*: by submucosal high-frequency bipolar electrocoagulation (Coblation) combined with out-fracture of the inferior turbinate.

-Functional efficiency:

- The nasal congestion gradually improved after surgery. After 3 months of surgery, 100% of patients improved their function. The average NOSE decreased from 34.01 ± 23.99 to 2.01 ± 5.03 .
- The internal nasal valve angle on both sides improved significantly after 3 months of surgery (the average internal nasal valve angle was $18,730 \pm 7.62$ and $19,050 \pm 6.61$ increased to $33,380 \pm 11.45$ and $34,650 \pm 13.54$ nose (R) and (L) before and after surgery, respectively).
- Nasal impedance and nasal airflow both improved significantly after surgery (total impedance 0.43 ± 0.16 Pa/cm³/sec decreased to 0.22 ± 0.04 Pa/cm³/sec; The total nasal airflow of 394.98 ± 132.13 liters/second increased to 711.33 ± 139.55 liters/second).

- **Aesthetic effect:** after 3 months of surgery, α angle improved significantly (average α angle before and after surgery was $19,15^\circ \pm 6.88$ and $0.85^\circ \pm 1.84$)

- After surgery, the rate of very satisfied patients is 57.5%, and satisfaction is 30%.

- Complications after surgery are not significant; the most common is keloid scarring of the chest wall due to rib cartilage removal (15%).

PETITION

1. More studies are needed to evaluate and compare the results between different PT methods and techniques.
2. Long-term follow-up studies after PT are needed to evaluate the stability of the surgery.
3. Larger sample size studies are needed to make the evaluation of the results clearer