MECHANISM OF FRACTURE OF THE NASAL CARTILAGES: AN EXPERIMENTAL STUDY

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The subject of acute nasal fracture seems to be simple and well understood **(Becker, Maliniac, Rosedale, Seiferth).** If the fracture is complicated with evident dislocation of the bony pyramid the diagnosis should be easy to determine. Careful examination of the nose and x-ray exposures will help to detect the fracture.

However minor damage to the cartilaginous vault of the nose might be overlooked, particularly if there is bleeding into the tissues and swelling. In cases of epistaxis the examiner should suspect a fracture, because bleeding indicates tear of the mucous membrane which in its turn is caused by a small cartilaginous fracture **(Cottle).**

Knowledge of some of the basic principles of fracture mechanisms is important, because the nasal pyramid being composed of bone and cartilage the possible varieties of fracture are almost innumerable. Analysis of the accident, particularly of the direction of the injuring force should help us to locate the site of the fracture.

The basic principles of the mechanism of nasal fracture are described by **Fomon.** It is not the purpose of this paper to consider fractures of the bony pyramid. Our interest is centered in minor damages to the cartilaginous vault and how the cartilages react to them.

We investigated cartilaginous fractures in the noses of 8 cadavers ** by striking them with a little hammer. Each nose was struck only one slight blow. Then the nose was spinned and frontal sections were made through the cartilaginous dorsum from ventral to dorsal over a distance of 3—4 mm.

Judgement of the severety of fracture of the cartilaginous pyramid and septum needs consideration of the normal anatomy. The cartilaginous vault is comprised of the upper lateral cartilages and the cartilaginous septum, to which they are fused. The findings of **Straatsma and Straatsma** as to the cartilaginous framework shows that the upper lateral cartilages and the cartilaginous septum are separated in the valve area by connective tissue. Proximally the three cartilages are fused with one another forming a double roman-style arch.

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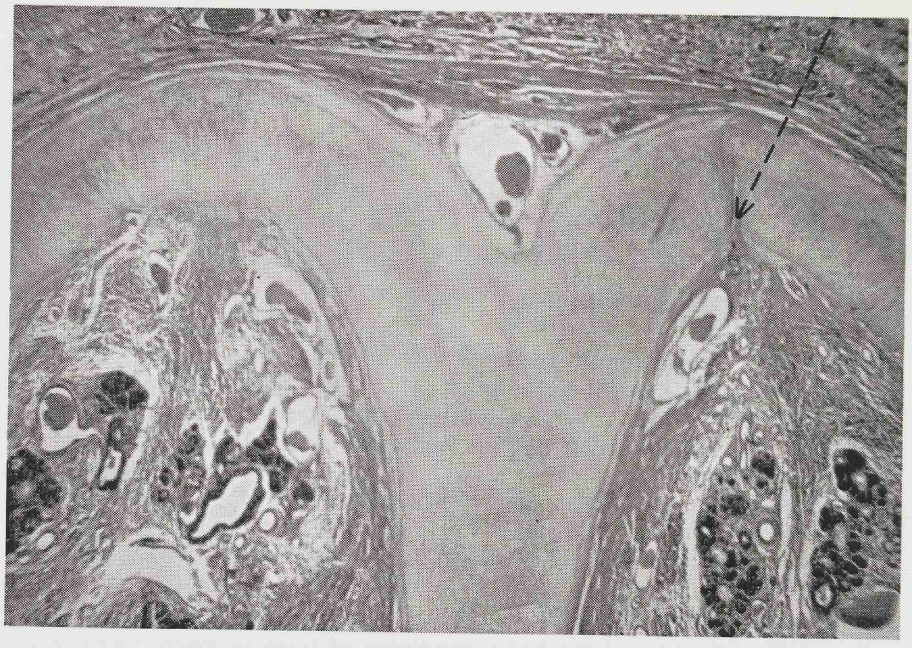

Fig. 1

Converse seems to believe that there is proximal separation of the cartilages by a tiny layer of connective tissue. I have found that the penetration of connective tissue may vary. Fig. 1 shows a frontal section of the cartilaginous dor-

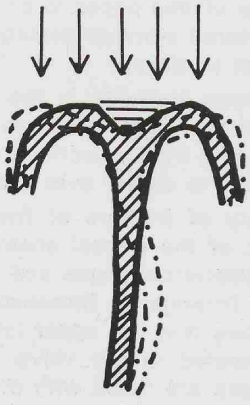

Fig. 2

sum. On the right side the septum and upper lateral cartilage are connected continously in one arch, while on the left side a tiny of connective tissue separating the two is evident.

The elasticity of the cartilaginous vault is important in understanding fractures of this region. The cartilage of the nose is able, due to its elasticity, to bend to each side before fracturing. If the nose is pushed in from the front the cartilaginous arches are flattened and the upper lateral cartilages will buckle outward (fig. 2).

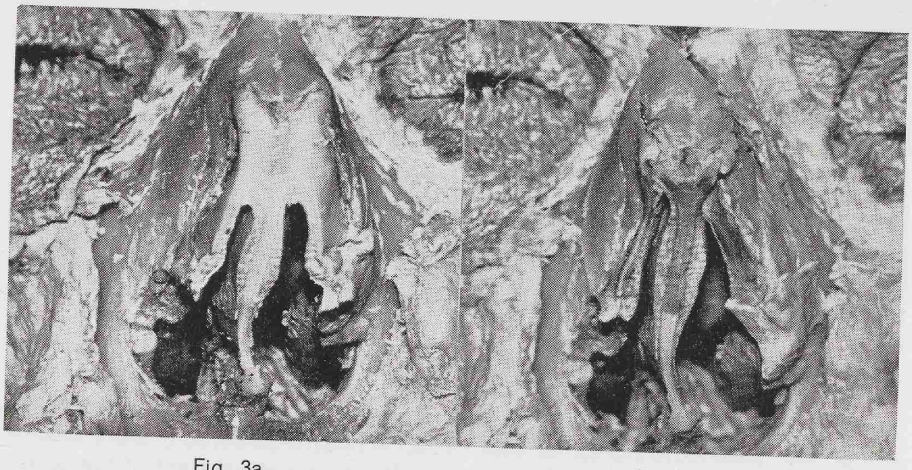

Fig. 3a

Fig. 3b

According to **Fomon** damage to the septum depends upon two factors: 1e. its attachment to the vomerine sulcus: and 2e. its relationship to the upper lateral cartilages. In addition the connection between cartilage and bone in the keystone area according to **Straatsma and Straatsma** is very firm. For

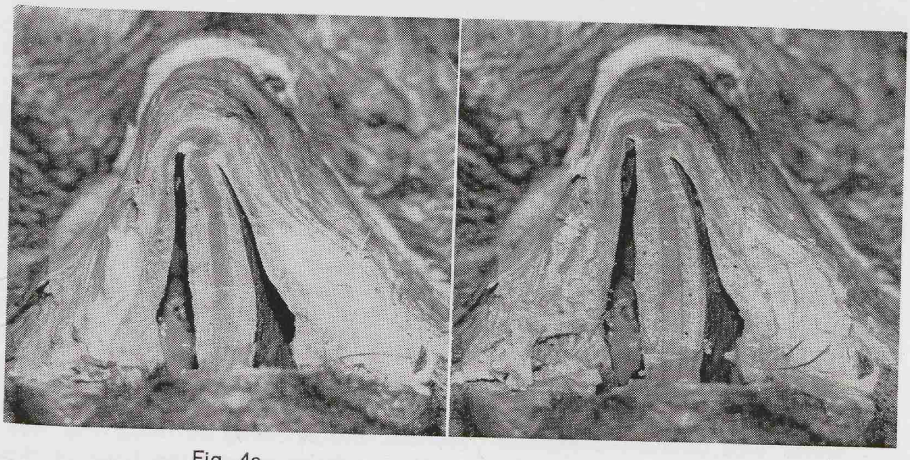

Fig. 4a

Fig. 4b

this reason it is quite understandable that a fracture with dislocation of the bony pyramid will usually involve the cartilaginous vault and change the air-

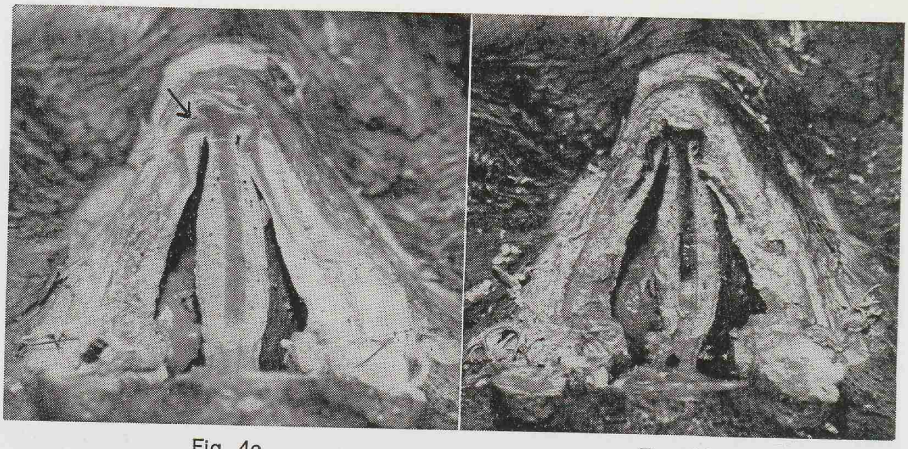

Fig. 4c

Fig. 4d

space of the nose. The broken bone will take the cartilage with it (fig. 3a and b).

Our results in experimental fractures are described briefly below.

1) A blow from the side: (fig. 4a - d): A remarkable difference in the width of the nasal cavity may be seen. The cartilaginous dorsum turns toward the side of the direction of the injuring force. The attachment of the upper lateral cartilage to the septum seems to be more involved on the contra-

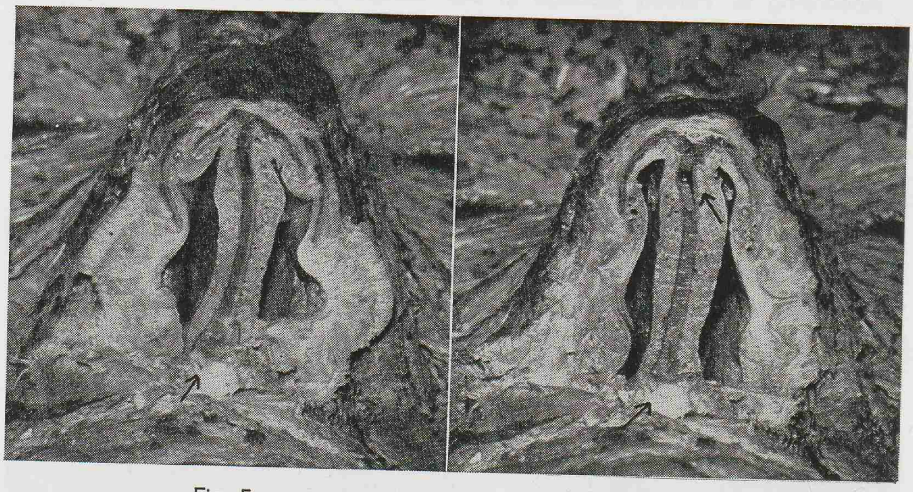

Fig. 5a

Fig. 5b

lateral side, while the septum overrided the buckling cartilage (fig. 4c). The cartilaginous septum did not show a fracture and the base of the septum was intact.

2) A blow from the front (fig. 5a - d): Here the force of the blow on the septum causes it to slip out of the sulcus on the floor of the nasal cavity.

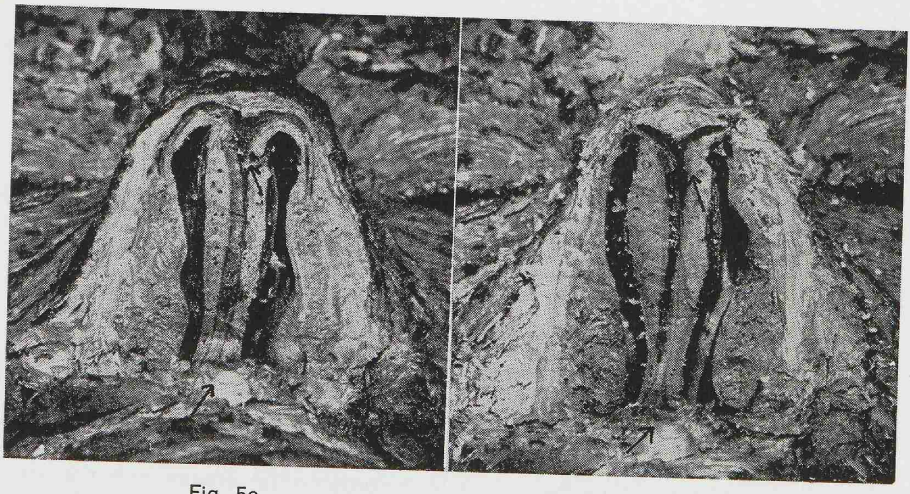

Fig. 5c

Fig. 5d

Such a dislocation would occur more readily in the vomerine area than over the premaxillary wings; fig. 5c shows the dislocated septum at the base and the fracture below the dorsum. In most dislocated fragments of the septum are noted in the keystone area (fig. 5d). In such cases the airspace of the nasal cavity shows an extreme broadening (fig. 5c) on both sides due to outbuckling of the upper lateral cartilages.

An experimental fracture is naturally not comparable to a nasal fracture in life. However it might be possible to derive some general principles from study of the anatomical specimen which might be transferred to physiological conditions. The weakest point of the cartilaginous vault seems to us to be the connection between the cartilaginous septum and the upper lateral cartilages. The second weak point we found to be located just below the Y-shaped junction of the wings to the septum. Injury of this area is difficult to detect in an acute nasal trauma.

Some consequences of a frontal blow might be considered. According to **Cottle** attention should be paid to slight injuries of the nose even when certain signs of fracture are missing. Furthermore a good breathing through the nose is not evidence that the septum has not been fractured (as shown in fig. 5c).

As to proper treatment, we prefer, along with **Cottle and Fomon,** open reduction with drainage of the hematoma. This technique provides a change to identify all fractures of the septum and upper lateral cartilages. Eighty per cent of the patients coming to us for nasal corrective surgery (76 patients during the past year) suffered from breathing difficulties resulting from nasal and septal fracture without proper treatment.

Knowledge of some of the principles of fracture should help to identify nasal injuries at early stage when treatment is of course easier than corrective surgery of old nasal fractures at a later date.

SUMMARY

The mechanism of cartilaginous fracture of the nose has been studied on 8 cadaver noses by experimental fracturing from the side and from the front. Frontal sections were made over a distance of 3—4 mm from the valve area up to the bony pyramid. In cases of sidewall fracture the attachment of the upper lateral cartilage to the septum was usually separated while in cases of frontal fracture of the cartilaginous vault the septum showed a dislocation at the base and fracture below the Y-shape cartilaginous junction at the dorsum. Open reduction is suggested as the proper treatment.

ZUSAMMENFASSUNG

Experimentelle Knorpelfrakturen der Nase wurden an 8 anatomischen Präparaten ausgeführt, indem je 4 mal die Nasen von der Seite und von vorne mit einem kleinen Hammer leicht verletzt wurden. Durch Frontalschnitte durch das knorpelige Nasengerüst wurden die Predilektionsstellen der Knorpelfrakturen bestimmt. Als schwacher punkt im Knorpelgerüst erwies sich die Verbindung zwischen Septum und Seitenknorpel sowie das knorpelige Septum dicht unterhalb der Septumgabel. Als therapeutische Konsequenz wird die blutige Einrichtung bei Knorpelfrakturen empfolen.

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