

NASAL INJURIES IN CHILDREN

Richard B. Hadley, M.D.

This discussion will be limited to nasal injury in children up to the age of fifteen years, as beyond that age, the problems are essentially the same as we encounter in adults. It has been stated that the most common injury that occurs to man is a blow to his nose and most of these occur in childhood. (1) The difficulties encountered in handling an apprehensive, frightened, injured child have frequently led to delay of treatment or no treatment at all. The advice to wait for swelling to go down before evaluating the extent of injury has often resulted in unnecessary, irreparable loss of cartilaginous structures. The problems peculiar to injury to the child's nose are:

1. The difficulty of accurate diagnosis of the injury.
2. The fact that aside from the small nasal bony arch the nose is largely cartilage in early years.
3. Injuries to growth centers in cartilage and bone often result in disturbances of growth and development into the normal characteristics of the adult nose.
4. General anesthesia is often needed to make an accurate diagnosis and surgical correction of the injury.
5. Radiological studies do not reveal cartilage changes and may be misleading to both physician and parent.
6. Destructive hematomas and fractures of the septum or cartilaginous vault frequently are not recognized or treated.

Embryologically the entire nose in man is cartilaginous. At birth only a little of the vomer and perpendicular plate of the ethmoid are osseous. The bony elements of the external pyramid and septum are formed in the perichondrium of the cartilage and gradually replace the cartilage. The septal cartilage and cartilaginous vault (upper lateral cartilages) are a continuous piece of cartilage. This cartilage compound extends for a considerable distance under the nasal bones and provides support. (2) The attachment of the cartilaginous vault to the under surface of the nasal bones is by thin fibrous bands, which may be rather easily detached by injury or hematoma. The important growth centers are located in the pre-maxilla and perpendicular plate of the ethmoid (Mosher) (3). Injuries to these growth centers may cause either acceleration or retardation of growth and development of the septum, teeth, palate, pyriform aperture, and maxillae. Cottle described this as the center of the septum

Director Otorhinolaryngology, United Hospital, Port Chester, New York.

mosaic. Early care of these injuries should prevent or minimize later deformity and assymetry. The nasal bones are formed from separate ossification centers located near the center of each nasal bone.

There are three important periods of growth of the nose:

1. First five years — one of relatively rapid growth.
2. Second five years — a period of relative quiescence with slower growth and changes in differentiation.
3. Third five years — a period of rapid growth and developmental change into the adult nose.

Injuries in the first or second five years may not become apparent until the accelerated growth during the third five years. Relatively minor injuries can result in varying degrees of assymmetrical growth of the maxilla as well as the nose. Malocclusion and malalignment of the upper jaw is a frequent result of early nasal injury. Disproportionate growth of one or more parts of the nose may result in disharmony. Retardation of growth of the whole nose can occur, resulting in a well differentiated nose with adult characteristics, but which is too small for good function in the adult. Also, failure in differentiation but normal growth can result in a nose of normal size with the characteristics of the infant nose. This is particularly true of the lobule of the nose and becomes apparent when we look at the base of the nose. Here we see the normal base view of a young child and here we see essentially the same in an adult, whose normal lobule should be pear-shaped such as this. Not only is this nose cosmetically unacceptable in the adult, it does not function well.

Studies have shown that from five to seven percent of newborn children have a significant injury to their nose. (4) The distance from the tip of the nose to occiput is usually as great or greater than the chin to occiput measurement. (5)

In every normal delivery, marked compression of the nose occurs. Posterior presentations cause a higher degree of injury as the result of more extensive rotation of the head. Eighty percent of newborn injuries show deviation of the external pyramid to the right with the septal cartilage displaced from the maxillary and vomerine ridge to the left. Since the newborn septum is almost entirely cartilage, which is very resilient, most of these tend to return to normal by the end of three months. It is sometimes possible to reduce this type of injury soon after birth. The nose is grasped by thumb and forefinger and the septum is elevated and rotated, replacing it in the midline. This may be done by the obstetrician, and he should be made aware of this injury. Occasionally, a lateral displacement of the bony pyramid as well as the cartilaginous vault is seen at birth. Some of these cannot be moved and may represent intrauterine injury with healing before birth. (Kirchner) (6). Many of these will also return to the midline by three to four months of age. This may be the result of totipotence, which is the potentiality of tissues to return to a normal, predestined pattern. (7) These children should be seen periodically for several years to determine whether or not growth centers have been injured and what the effect of the injury has been on later growth and development.

The problem of diagnosis of the young child's injury to his nose is often difficult, yet it is our duty to be sure we have made an accurate diagnosis before deciding to do nothing or to attempt any repair. It is most important to examine the internal nose carefully to determine whether or not there are lacerations or hematomata of the septum or cartilaginous vault. This may often require general anesthesia and this is worthwhile even if no surgery is required. You must expect injury to the septum in every case unless you can prove it is not so. X-Rays should be done for legal purposes, even though they may not help us in our diagnosis or handling of the case. Photographs make an excellent record and should be taken whenever possible. A Polaroid camera is valuable for use in the office or hospital.

Septal hematomas are one of the common injuries in children and may result from a relatively minor bump on the nose with no bleeding or obvious deformity. They may cause no symptoms other than a stuffy nose. These must be evacuated as soon as possible. Extensive destruction of septal cartilage can occur in a short time, resulting in sagging or saddling of the cartilaginous vault, retraction of the columella, widening of the base of the nose, and disturbance of the upper lateral cartilage septal valve with resulting poor function and marked cosmetic defect. A hemitransfixion is the best septal incision. (8) It allows elevation of either or both septal flaps and does not damage mucosa, since it is made in skin. The hematoma should be evacuated, both sides of the nose packed with gauze, and a tape dressing and stent mold applied. If cartilage has been destroyed, it is often possible to move a piece of cartilage from the posterior portion of the septum forward to fill the defect. If this is not possible, preserved cartilage should be used. Even if the hematoma has become a septal abscess, cartilage should be used to fill the defect. It will help minimize scarring of the septal flaps and the resulting saddling of the cartilaginous vault from the pull of scar tissue. Intranasal packing is left for five to seven days.

Another frequent and dangerous injury in children is the cartilaginous vault injury. Often there may be associated septal injury, but there may be only a hematoma over the upper lateral cartilages. The danger of this injury is that the upper lateral cartilages may be torn away from the under surface of the nasal bones by the injury or the hematoma may dissect between the cartilages and the nasal bones, resulting in detachment of the cartilages from the bones. Necrosis of the cartilages may occur. This may not become apparent until a considerable length of time after the swelling has subsided. This hematoma is seen as a bluish bulging in the cul-de-sac of the vestibule between the lower lateral cephalic edge and the caudal edge of the upper lateral cartilage. It should be evacuated through a small intercartilaginous incision. The nose should be packed to re-approximate the upper lateral cartilages with the under surface of the nasal bones. A tape dressing and stent mold should then be applied. Occasionally it is wise to leave a small piece of rubber drain in the intercartilaginous incision for twenty-four hours. The more extensive injuries to the nose are handled essentially the same as in adults. Displacement of the bony pyramid usually means that there has been some degree of septal injury as well. Since much of the septum is still cartilaginous, simple closed reduction of the fracture is possible at times.

However, if there is any question of fracture-displacement of the septal cartilage or developing hematoma, it is best to open the septum. The fractured elements can then be repositioned and the nasal bones can be elevated back into position from within the septal space, avoiding further injury to the mucosa. Lacerations of the septal mucosa and lateral wall frequently at the edge of the pyriform aperture will usually heal readily. However, if there is poor apposition of the edges, they should be sutured with 4-0 or 5-0 chromic catgut. If old septal deformities such as subluxation, deviation, ridges, or impacted spurs are present, these should be corrected at the same time that the injury is repaired. This can be done at any age and may prevent further surgery at a later date.

Major injuries of the nasal pyramid are often more easily handled than those with only a small amount of displacement. Green-stick type fractures occur frequently and often are not correctable by the usual closed method of reduction. In the past, there has been reluctance to do osteotomies on these children, especially if they are under twelve to fourteen years, yet it is frequently impossible to straighten the nose without doing lateral osteotomies on one or both sides. It has been shown that the ossification centers of the nasal bones are not injured by the usual medial or lateral osteotomy, and experience has shown this to be true. (9) One can and should do osteotomies, whenever it is necessary.

General anesthesia is usually necessary in children up to the age of fifteen years, although occasionally a child of even ten or twelve can be done under local anesthesia. It is wise to remember that digestion may stop at the time of injury, so that a child may still have a full stomach six or eight hours after the injury. Unless there is uncontrolled bleeding or extensive hematomata, it does no harm to wait for twenty-four hours or longer. Ice compresses and administering one of the enzymes to reduce swelling are helpful and may allow one to evaluate the extent of injury better. If general anesthesia is used, it is still worthwhile to use cocaine and adrenalin intranasally and to infiltrate one percent xylocaine or monocaine with hyaluronidase extranasally. This helps decrease bleeding and cuts down on the amount of general anesthesia needed.

The after care of nasal injuries in children should include a much longer follow-up than similar injuries in adults. The intranasal packing is usually removed gradually after five to seven days. Tape and thin metal splints should be kept on for two weeks or more in any injury involving the bony pyramid and septum. Young children should be checked and photographed, if possible, every six months or so for several years to determine whether or not disturbances of growth and development of the nose has occurred. Work being done on pressure testing has proved to be very important in the diagnosis of disturbed function. Objective testing is needed and often shows trouble that may not otherwise be apparent.

Parents should be made aware of the fact that further surgery may be needed as the result of scar tissue or disturbances of the normal growth pattern.

This is true in any nasal surgery, and it is particularly true in children. Small pieces of fractured septal cartilage may each grow so that several layers of cartilage develop, causing nasal obstruction. You must be aware of such sequelae of early injury and of the sequelae that can occur as the result of your surgery.

At what age should you do surgery on a child whose nose has deformity or defects of development and growth as the result of early injury? In the past it has been taught that septal and rhinoplastic procedures should not be done until the age of fifteen or sixteen because of the dangers of disturbing growth centers. This can be true, especially if the perpendicular plate of the ethmoid is injured. However, judicious surgery may help the function of the nose and may prevent the development of more extensive deformity. Severe septal obstruction should be corrected often as early as six or eight years of age. Osteotomies and repositioning of the bony pyramid can be done at a relatively early age also, and may prevent the development of more extensive deformity as the child grows. Retarded growth and differentiation of the lobule can frequently be stimulated by cutting through the lower lateral cartilages at the dome. Retarded growth of the whole nose can be stimulated by disimpacting the nasal pyramid with lateral osteotomies and outfracture of the lateral lamina. Small deformities in the young child occasionally will correct themselves, but they more frequently become more marked as the child grows. In summary, the following are some of the important considerations in the treatment of nasal injuries in children:

1. Make an accurate diagnosis, even if it requires general anesthesia and elevation of septal flaps.
2. Be aware of the newborn injury and the possibility of later disturbances in growth and development of the nose.
3. Look for hematomas of the septum and of the upper lateral cartilage vault. Try to evacuate them as soon as possible and replace the cartilage if it has been destroyed.
4. Do not hesitate to do medial or lateral osteotomies, if they are necessary to correct deformities of the nasal pyramid.
5. Observe children for several years after a nasal injury and make the parents aware of the possible need for surgery at a later date.
6. The treatment of a child with an injured nose should be one of the most rewarding and gratifying medical experiences. Handled with a little understanding and affection, children will often tolerate much more discomfort than adults. They heal quickly and have fewer complications. Psychologically they often seem to be quite stable. It is interesting to note that often their primary concern is the appearance of their nose, rather than whether they can breathe through it.

BIBLIOGRAPHY

1. Cottle, Maurice H.: Introduction to Fundamentals of Surgery of the Nasal Septum and External Pyramid. 1953.
2. Cottle, Maurice H.: Nasal Roof Repair and Hump Removal. A. M. A. Archives of Otolaryngology, Vol. 60: 408-414 (Oct.) 1954.

3. Mosher, H. P.: The Influence of the Premaxilla Upon the Form of the Hard Palate and Upon the Septum: Items of Interest 1907. *Laryngoscope*, Vol. 17: 840-867 (May) 1907.
4. Philpott, Ivan; Chessen, James: *Laryngoscope*, Vol. 65, (Feb.) 1955; and Cottle, Riggs, Hinderer, Philpott et al, A. M. A. Exhibit (June) 1956.
5. Gaynon, Irving: Presented at A.M.A. Exhibit (June) 1956.
6. Kirchner, J. A.: Traumatic Nasal Deformity in the Newborn, A. M. A. Archives of Otolaryngology, Vol. 12: 139-142 (Aug.) 1955.
7. Cottle, M. H.: Presented at Chicago, 1953. Introduction to the Fundamentals of Surgery of the Nasal Septum and External Pyramid.
8. Cottle, M. H., and Loring, R. M.: Surgery of the Nasal Septum-New Operative Procedures and Indications. *Ann. Otol. Rhinol. and Laryngol.*, 57: 705 (Sept.) 1948.
9. Steiner, A.: Certain Aspects of Nasal Trauma in the Prenatal Period. *Maryland State Medical Journal*: Vol. 8, 557, 1959.
10. Morrison, Lewis E.: Children's Injuries. Presented at Annual Meeting of American Rhinologic Society (Oct.) 1957, Chicago, Ill.
11. Aagesen, W. J.; Morrison, L. E.; Spath, Carl B.: How to Handle Acute Nasal Injuries. A. M. A. Archives of Otolaryngology, Vol. 60: 367-370.
12. Klaff, Daniel D.: Surgical Anatomy of the Antero-Gaudal Portion of the Nasal Septum: A Study of the Area of the Premaxilla. *Laryngoscope* 66-995-1020, 1956.
13. Spath, Carl B.: The Management of Nasal Injuries: Anatomic and Physiologic End Results. Presented at the Annual Meeting of the American Rhinologic Society (Oct.) 1957, Chicago, Ill.