

PHYSIOLOGIC RETURNING OF THE UPPER LATERAL CARTILAGE

Vernon D. Gray, Los Angeles, California, U.S.A.

Returning of the upper lateral cartilage is technically an outward curling of the anterior inferior corner and the immediate lateral portion of its caudal edge, considered minimal, moderate or complete depending upon the degree. Because of the wide variance in descriptive anatomy of this area, and for those perhaps unfamiliar with it, a word of anatomical orientation may be of help. The upper lateral cartilage is a projecting wing on each side of a three winged cartilaginous complex, the septal, quadrangular cartilage making the third. This three winged complex comes from the same embryonic substance and develops as a single unit. The upper laterals are joined along the cartilaginous dorsum and remains so until it goes under the lobular cartilages where the laterally projecting leaves continue forward without this attachment to the septal cartilage. It is this final, free edge and its role-up reflection or "returning" that this paper is about. It is a small area, over-lapped normally by the lobular cartilage and generally overlooked in surgery of the nose as being of physiologic significance. I hope to show that it is a normal occurrence, is uniquely designed to do a job, and possibilities as to its development.

There are many reasons that knowledge and literature regarding this area is sparse and that "returning" being "physiologic" is absent. Some of the more obvious reasons might be:

1. Anatomical dissections are limited primarily to cadavers wherein the cartilage undergoes almost immediate changes, in particular in losing its spring-like elastic behaviour.
2. An extremely varied anatomical configuration of this part as to shapes and sizes has not led to easy cataloguing.
3. Nasal surgery to this day has been so overwhelmingly cosmetically oriented that ones being functionally conscious is a rarity.
4. Lack of surgical dissection under magnification and proper lighting, which I consider probably the most significant.

That this caudal end of the upper laterals is important cosmetically can be easily attested too, as it is removed in part in almost every surgery. It is important functionally as it forms the spring part of the lateral wall which makes up a part of the alar valve, probably the most significant inspiratory valve of the respiratory tract. One must wonder if the cosmetic removal and functional concern can exist on common grounds in top notch rhinologic surgery. Might the damage to the valve be offset by the cosmetic advantage?

This study was made from the meticulous surgical dissection of the caudal end of the upper lateral cartilage on more than one hundred living Caucasian

patients without history of previous surgery. "Returning" to some extent was noted in almost every case prior to separation of any of its perichondrium. After separation, however, it was found in all but nine cases, which presented very interesting findings detailed later in this paper.

Intense illumination and 2-6 power magnification was used throughout surgery. The approach was through a cul-de-sac preserving intercartilaginous incision using a Bard Parker 15 blade for the skin, an angulated 66 beaver blade and sharp scissors being used for the final dissection. Perichondral elevation was carried from the caudal end of the cartilage, even though "returning" sometimes placed it superior to the reflected edge, and intranasally until no further movement of the cartilage was noted. If the returning was reflected upon itself, it was then separated from its perichondrium.

It is important that the perichondral separation proceed in sequence prior to any incisions into the cartilage, as this would greatly effect the natural spring action or greatly minimize it. This may well explain why many experienced surgeons are unfamiliar with its occurrence as their approach, as a rule, is by cutting and then removal, often without the dissection.

In effect, we end up with the caudal end of the upper lateral denuded of its perichondral attachments to the extent that higher separation, on either surface, produces no further curling. The caudal edge grossly appears as being of uniform thickness and separated from the quadrangular cartilage for a varied distance, usually about one centimeter. The tip (anterior inferior corner) curls outward and to a greater degree than its more lateral parts, uncurling as it goes to a point approximately 6-8 mm where it then continues flat. It is this point which produces the angle which can be visualized clinically and which I feel gives the leptorhine upper laterals its trapezoid configuration. Presence or absence of the point from a clinical standpoint may give some clue as to what will be found surgically.

As there is an increase in the curling tendency of the cartilage upon separation of the perichondrium and its overlying soft tissues, it is obvious that it created a fixative relationship so that the cartilage was held in an unnatural uncurled position under tension. The alar valve then has a "pre-loaded" lateral surface which may well suit it ideally in the physiologic functioning of the alar valve. Another very important factor which affects a similar response to pressure, and related to this curling, is the connective tissue attachments along this caudal edge which extends up and over the superior surface of the cartilage to a similar attachment to the opposite side.

This unique intrinsic natural shape of the elastic cartilage, its pre-loaded condition, aided by the connective tissue attachments allows movement of its more lateral flat parts to move to a more medial position with the least extra nasal pressure, primarily brought about by air pressure differential (intra and extra nasal) and that exerted by the rotation of the lobular cartilage pressing its superior edge against the cartilage. A word regarding "differential pressures" — using a part of Bernoulli's equation. As the velocity increases, intranasally on inspiration, the air pressure drops, becoming sub-atmospheric. Thus the external air pressure being higher, pushes the lateral nasal wall (I.E. upper lateral) medially towards the septum thus narrowing the valve. As the differential pressure increases, moving more of the lateral wall me-

dially, from its lateral parts first and then more of the curling becomes involved so that progressive resistance is encountered. In other words, as the fulcrum is moved to a more medial position, the more curling is involved, the connective tissue stretches and the greater the resistance to further collapse. The valve itself, being more narrow at its vertex has the highest velocity, the lowest pressure and the greatest tendency to collapse. The unique returning and connective tissue attachment produces progressive resistance exactly where it is needed.

Where the returning "curl" is more than 90 degrees, not only would the flexibility be greatly affected, but the fulcrum would be placed more laterally so that pressure and valvular shape would dramatically change, thus function. Complete returning would effect everything, causing a rigid type leading edge, double if not more in thickness, and completely abnormal in shape which would compound the problem.

The alar valve, composed primarily of the septal wall and the lateral nasal wall at the os internum, must be mobile. Though it may sound incongruous, the lateral nasal wall must move medially to narrow the valve as the need for greater inspiratory flow is demanded by the body, until being insufficient, mouth breathing takes over. As the flow and velocity increases within the valve area, a pressure drop develops, becoming sub-atmospheric so that the air pressure outside of the nose pushes the lateral wall medially. The higher the velocity the greater the tendency for the nose to collapse. For this reason, the caudal end of the lateral leaf of the upper lateral cartilage must move medially and perhaps downward in a very specific manner and not as a simple hinge-type movement with the fulcrum at its junction near the septum. It is essential that as the valve is narrowed, the tendency to collapse must be progressively resisted, narrowing must occur without collapse. A normal nose cannot be collapsed by inspiration.

Returning of the caudal end of the upper laterals along with its soft tissue attachments can be architecturally a perfect design to aid in the type of movement demanded by the valve, to allow slight movement with low or high volumes of air and to resist collapsing as it narrows.

It was not infrequent, in particular when complete returning was present, that when separated free to more or less open itself that the fold, per se, appeared somewhat thin and at times almost separated from the main body of the cartilage, not at all what one would expect if the edge was simply folded back upon itself. It was as if a person took a thin piece of metal and bent it back and forth until at the fold it was all but separated.

As mentioned before, there were nine cases in which no returning was found and each of these presented the same significant anatomical variation. It was as if someone had separated the caudal two or three millimeters from itself so that in effect a separate piece of cartilage existed. Originally I personally accepted this as an improper inter-cartilaginous incision in that I had cut a portion of the cephalic border of the lobular cartilage. This problem was circumvented by using a 15 Bard Parker blade for the skin and then carefully separating the tissues and then the cartilages, so that I was sure that I had not separated any separation found. Upon further meticulous dissection under magnification, it became obvious that this finger-like cartilaginous edge was free until at the most lateral border of the upper lateral where there

was a complete and solid attachment to the existing cartilage. At the anatomy lab. of the University of Pittsburgh, School of Medicine, out of eleven consecutive cadavers dissection of the nose, two showed this unique anatomy. Once found, for obvious reasons, I had Dr. Lewis Morrison of Indianapolis dissect these under magnification who confirmed the findings, and which were witnessed by four senior members of the American Rhinologic Society and the professor of anatomy. In view of the cases wherein "returning" was present and there appeared an almost complete separation, and the nine cases found where they were all but separated except at the most lateral edge make me feel possibly that a separate growth center occurs laterally and projects normally towards the septum and fuses at a later date. Further this projection and growth within the perichondrial envelope may then explain the possibility of returning by reason of natural growth, rather than assuming it simply too long for the envelope and having no where else to go folds back. Another finding not too uncommon that makes me feel this possibility of growth exists is that the anterior-inferior corner itself not infrequently projects beyond the corner, twists and bends and at time goes completely to the opposite side.

Present day pressure flow tests suggests that "returning" much over ninety degrees produces pressure flow relationships that are not conducive to normal pulmonary exchanges of gases. Other clinical and laboratory tests and their interpretations, in particular the PO_2 studies has forced a reassessment of the alar valve, its position, shape and mobility in explaining nasal inspiratory and expiratory problems not produced by other known nasal factors.

It may well be that as refinements in testing procedures develop that normal configuration for the returning and its effect upon the valve may be decided upon. Until such times, an awareness of "returning" and its potential will, if nothing else, keep one from approaching this area casually.

SUMMARY

Some degree of "returning" of the caudal end of the upper lateral cartilage occurs in over 90% of living Caucasian patients, thus suggesting a normal finding. Over 90% showed evidence of intrinsic outward curling which did not reveal itself until separation of its perichondrial envelope which held it in an unnatural position under tension. An attempt has been made to show that this unique design and shape could well have a definite physiologic participation in the functioning of the alar valve.

A suggestion as to the development of this "returning" that would make it a functional development rather than as a direct result of trauma and cicatricial change.