FOREWORD

To write a book is an arduous, time consuming and, occasionally, a very frustrating endeavor. When Dr. Gary Burget mentioned to me he was looking for a publisher for a new book he was developing on nasal reconstruction, I suggested he publish it himself. Little did I know he would take my advice to heart. What a task! Dr. Burget has compiled his experience of more than 25 years in the most difficult area of reconstructive plastic surgery: the nose. This is particularly true in the area of nasal reconstruction in children. He included all of the cases he has performed over a 24-year period, analyzed them, illustrated them, photographed them and self-criticized each one to indicate areas where he could have done better. This is rarely seen in other books, and is only possible if the author is also the operating surgeon.

Plastic surgeons have been pondering nasal reconstruction since time immemorial. Dr. D. Ralph Millard, showed what I, personally, thought were spectacular results, and I believe he served as a role model and teacher for Dr. Burget. As is true of the best students, they surpass the teacher, and that is the case with Dr. Burget. He, in my way of thinking, is the one that has been able to synthesize the principles, concepts and precise molding of structures, all of which are necessary to aesthetically reconstruct the nose. He now presents this knowledge, so that reconstruct the nose.

True masters are never self-centered; they want to give us the tools needed to reproduce their results, and that is what Dr. Burget has accomplished with his very didactic, step-by-step compilation. It only includes eight chapters, but each one addresses the subject matter with considerable detail. More importantly, each chapter contains self-critical analysis of Dr. Burget’s own techniques summarizing his good judgments as well as misjudgments. This is unique! Most of us will include our best cases to illustrate a particular procedure and disregard, or pay limited attention to, the problem cases or complications.

The patient who has lost a nose is looking for only two things, as indicated by Dr. Burget. The new nose must breathe easily, and have the appearance of a normal, natural nose. To accomplish this is not easy, but again Dr. Burget indicates that artistry in nasal reconstruction can be learned. Although artistry, the visual eye and attention to detail, cannot be easily reproduced, if one is to follow the guidelines espoused by Dr. Burget most of us can achieve satisfactory results in reconstructing a nose. As he states, “concepts are seldom taught, but they can be learned.” Two things are extremely clear in the book: one is that reconstruction in children should start at the age of 3.5 years, if possible, so that the child can go to school with a normal-looking nose that breathes easily. The second point is that for the surface nose covering, we have an almost providential source of tissue in the midline of the forehead. The book does include one spectacular case in reconstructing the nose on a burn patient who had no avail-
able forehead. For this patient, Dr. Burget was able to change a “papaya blob” into a distinct nose by paying attention to what he calls “all of the partitional subunits” (see Chapter 4). This, indeed, is spectacular.

The association with Dr. Robert Walton, another most innovative and technically facile plastic surgeon who provided the microvascular flaps for lining of some of the reconstructed noses, has been most worthwhile. Dr. Walton has similarly shown us the principles for lining the nose, providing for nostrils of adequate size as well as air passages through which the patient can breathe easily.

The book emphasizes and repeats principles, but repetitions are important because, as Dr. John W. Kirklin indicated, the training of horses, quarterbacks, pilots and surgeons “is based on repetition and occasional rewards (a carrot).” I, for one, will not forget that the forehead flap design should be vertical, or within 15 degrees of vertical in the forehead. The flap should be long enough to reach the most inferior part of the nasal defect. The base of the flap should be no more than 1.5 cm wide. The flap should be sized precisely, not too small and not too large, and we should never reduce the dimensions of the flap to benefit the forehead and facilitate its closure. “To cheat the nose in order to benefit the forehead,” is a confusion of priorities.

Chapters seven and eight on “Complications: Prevention and Management” and “Longevity and Long-term Follow-up,” respectively, are invaluable. Dr. Burget is clear and most honest on reviewing his complications and offers advice to help us avoid them. He effectively demonstrates that a well-reconstructed nose will last for the patient’s lifetime.

This book is unique and a “legacy” as indicated in the thank you note included in the Epilogue. Dr. Burget wants to convey what he has learned in his long professional career about nasal reconstruction. He wants to transfer all of his concepts as well as his techniques so that most of us can reconstruct a nose in a very satisfactory fashion. What a legacy! In an unselfish way, Dr. Burget, both in this book and in his previous book, Aesthetic Reconstruction of the Nose (Burget, Menick, 1994) has illuminated an area of reconstructive plastic surgery that was previously one of the most difficult to approach and obtain a satisfactory result. The time Dr. Burget spent in collecting his thoughts and his cases are, indeed, a labor of love. The book will be a classic as it is printed.

Luis O. Vasconez, MD
Professor of Surgery (Plastic Surgery)
Vice-Chair Department of Surgery
University of Alabama at Birmingham
Birmingham, Alabama
CONTENTS

CHAPTER 1
WHEN AND HOW TO RECONSTRUCT A CHILD’S NOSE 1

CHAPTER 2
RECONSTRUCTION OF THE NASAL TIP SUBUNIT 49

CHAPTER 3
RECONSTRUCTION OF LATERAL DEFECTS OF THE NOSE 103

CHAPTER 4
SUBUNIT PARTITION OF FLAPS 172

CHAPTER 5
TOTAL RECONSTRUCTION OF THE NOSE 202

CHAPTER 6
RECONSTRUCTION OF COMPOSITE FACIAL DEFECTS:
NOSE AND ADJACENT FACIAL UNITS 271

CHAPTER 7
COMPLICATIONS: PREVENTION AND MANAGEMENT 315

CHAPTER 8
LONGEVITY AND LONG-TERM FOLLOW-UP 327
CHAPTER 1

WHEN AND HOW TO RECONSTRUCT A CHILD’S NOSE

SAMPLE FOR PREVIEW ONLY
©2012 Dr. Gary Burget
All rights reserved.
A young child with a badly deformed nose is a dilemma to a plastic surgeon. There is an impulse to do something soon, to rebuild the nose with a forehead flap. At the same time, a forehead flap may merely replace one deformity for another. It may also compound the deformity with an indelible donor scar. The additional fear is that the reconstructed nose will not grow as the patient grows and end up a small nubbin on an adult face.

Lesser operations are safer. Reshaping the nose with small local flaps, cartilage grafts, and composite grafts does less harm. Yet these techniques merely soften the deformity, never eradicate it. Amid these fears it is tempting to delay action. Yet if surgery is delayed until adolescence or adulthood, it is done too late. As the excerpt above illustrates, permanent damage to a child’s psyche and spirit is often complete following a childhood spent with a facial deformity.

In theory, reconstruction of a child’s nose should be no different from reconstruction of any nose; and, in truth, this book can be used as a guide to nasal reconstruction in general. However, special considerations do exist for reconstruction in the child. At birth the nose is underdeveloped—a primordium. It grows slowly until adolescence, at which time it suddenly erupts into a large and complex structure having layers, internal anatomic parts and a specific external aesthetic form.

The nose serves only two functions: it breathes, and has an appearance that allows the patient peace of mind. When a child is born with, or acquires a malformed nose, questions arise. Should reconstruction be done? If so, when? Because the normal nose does grow, which donor tissues will grow in step with the child? Will a nose constructed in childhood refuse to grow and become a tiny nub on the adult face? If reconstruction is done at an early age, which donor tissues will give the best aesthetic result? That is, which will produce a nose that has the dimensions, proportions and contours of a normal nose, plus a patent airway and normal surface color and texture? Which of the donor tissues are best to cover (with skin), line (with skin or mucous membrane) and support (with cartilage or bone) the new nose? Can a child’s nose be made to look normal and remain normal to adulthood?
This book will show that a nose reconstructed at about 3.5 years of age, using a paramedian forehead flap for cover, cartilage grafts for a framework and local or microvascular flaps for lining, will grow in step with the patient and will function well. It will appear to others to be what it is not—a normal, natural nose.

This is not to say that every attempt at pediatric nasal reconstruction with a forehead flap yields an optimal result. Unfortunately, many plastic surgeons do not receive training in the visual concepts and artistic techniques of nasal reconstruction. They are highly intelligent, well trained, and can adroitly swing a flap, but they do not have the artistic understanding to create a structure possessing the dimensions, proportions, and contours of a normal, natural nose. This ability can be learned. Aesthetic reconstruction of a child’s nose is right and proper, but only when a surgeon has mastered the technical and artistic skills required for an optimal result.

CAUSES OF NASAL LOSS AND DEFORMITY

In the following series of pediatric patients who underwent forehead flap reconstruction, the most common cause of nasal loss and deformity was congenital capillary hemangioma. These benign vascular tumors grow early in life and regress by approximately five years of age. Although small hemangiomas may regress to insignificance, the larger ones leave behind an amorphous bulbous mass covered with finely wrinkled non-pigmented skin that has no subcutaneous fat. When these tumors obstruct breathing or vision or trap platelets, they may require surgical excision in early life. They can grow rapidly and necrose. They generally shrink and become pale, that is, involute by approximately five years of age. When these events happen, major deformity can result, because part of the normal anatomical nose dies or was excised when the tumor was excised.Repairing the deformity without replacing skin is difficult, as the finely wrinkled non-pigmented surface skin that covers the involuted tumor is underlain by fibrous tissue and has no subcutaneous fat. Because it has no subcutaneous fat, the surface skin is difficult to contour, does not drape easily over cartilage or bone grafts and generally detracts from an otherwise normal or beautiful facial appearance. When significant deformity remains, I excise the involuted hemangioma and reconstruct the nose when the patient is approximately age 3.5 years.

Amputation by dog bite is the second most common cause of nasal deformity in children. The dogs most noted for attacks (pit bulls, rottweilers and German shepherds) are not the ones responsible for most nasal amputations. These dogs tend to grab a child by the face or neck and drag it off. It is the nice, “nippy” dogs, such as the golden retriever, Labrador retriever, dalmation and other hunting dogs, that bite off the nose. They seem to have an uncanny aim for the tip of the nose. They neatly nip off the tip subunit as they would the head of a small animal, except when on the rare occasion a child quickly turns his or her head and receives a lateral nip. The question of what to do when the amputated nasal piece is recovered is of consequence and will be discussed in a subsequent chapter (see Chapter 2).
Burn injuries of the nose are usually associated with loss of the forehead tissues. The soft parts of the nose are burned off, leaving the nasal bones and the two slits of the piriform aperture open to frontal view. For burn injuries, a depilated hair-bearing scalp flap or a microvascular free flap is needed as skin cover for the new nose. Neither is as effective as a forehead flap.

Iatrogenic nasal losses occur from the long-term use of nasal feeding tubes in a neonatal care unit that results in necrosis of the columella and vestibules. Suction-cautery devices and ablative lasers used in the nose also cause similar but more extensive injuries. Such devices usually destroy the nasal vestibule lining, septum, columella and parts of the alae.

In addition, I have encountered two cases of gunshot injury to the nose of a child, a severe idiopathic congenital nasal deformity associated with hydrocephalus, and necrosis of the nose caused by pressure upon it in the birth canal.

Those who are faced with a congenital or acquired deformity of the nose in a child ask three questions:

1) Can a normal-appearing nose be reconstructed?
2) When should a child’s nose be reconstructed?
3) What donor tissues are most appropriate?

**CAN A CHILD’S NOSE BE RECONSTRUCTED?**

With regard to plastic surgery of the nose, the patient has only two goals: to breathe easily and to have a good-looking nose. For the first 150 years of plastic surgery of the nose (1810 to 1960s), the focus was on creating new flaps and grafts and the means of transferring them. Artistry was minimal. In the 1950s, the innate artistic ability of Dr. Ralph Millard, Jr., made him the first to give natural form to reconstructed noses. He “saw” the surface subunits and elevated the nasal skin to carve them out of the deeper fat and scar.

New methods of tissue transfer—in particular, free microvascular flaps—make possible large and complex reconstructions of the nose, lips, orbits and cheeks that have the potential to appear normal. However, artistic progress lags behind technical ability. A surgeon can transfer a forehead flap, construct an airway and carve a hard-tissue framework and yet not construct a normal-appearing nasal structure. The performance of complex stages of surgery using microvascular flaps, engineered tissues or otherwise imaginative techniques does indeed train residents, enlarge curricula vitae, earn money for a department and generate a sort of fame, but does nothing for the patient when the hole is replaced by a “papaya.” A patient wishes only to breathe and to look good, so the surgeon must create the appearance of a normal, natural nose. To do this, the surgeon must be able to follow what I have termed the “Seven Key Steps to Reconstructing a Nose” (Table 1-1).
subunit flap cannot be used. Instead one is forced to cover the defect with a single haphazard flap that flows like fluid across unit and subunit borders. The flap is an amoeba-like mass. As the whole of the flap contracts toward a single center rather than toward the centers of individual units and subunits it obliterates nasal and facial contours. Application of what I have termed subunit partition breaks up this flap into its component units and subunits (see Chapter 5). Each component then contracts toward a separate center and thereby harnesses the force of wound contraction to enhance the natural form of the nose rather than destroy it. By use of this concept, an amorphous mound of skin and soft tissue transferred to the face may be given the form of a nose.

**Figure 1-3:** NASAL SUBUNITS: The nose is divided into subunits: nine geometric regions, each having a central highlight or patch of shadow. The borders of these subunits are lines of shadow paralleled by lines of light, where light meets shadow at a ridge or valley of the nasal surface. The nine nasal subunits are roughly geometric forms: 1) the dorsum is a hemicylinder; 2) the tip is a half-sphere; 3) the two soft triangles are small shadowed depressions; 4) the columella is a truncated cone; 5) the two alae are curved spindles; and 6) the two sidewalls are concave planes, like ski slopes.
the next three to five weeks. In most patients, the smooth depressed scar that remains at the site of the defect can be excised and closed primarily in two to three months, when skin tension in the forehead has decreased.

**CASE EXAMPLE: RECONSTRUCTION OF A CONGENITAL HEMANGIOMA**

**HISTORY**

A healthy and bright girl was born with a salmon patch on her nose. This rapidly grew into a protuberant hemangioma the size of a golf ball (Fig. 1-6A) that subsequently necrosed, and bled before it began to regress. The tumor was partially excised at age four years.

As the tumor involuted, her nose became foreshortened and non-projecting, and the nostrils elongated vertically and were open to frontal view (Fig. 1-6B-D). The lower half of the nose, except for stumps of the alar bases, was missing. The nasal defect had contracted pulling what remained upward and medially. The patient presented at age 9.5 years. She was taunted in school, yet bore her deformity with stoicism. She was also very bright and, therefore, participated in the decision to pursue a forehead flap reconstruction.

**DIAGNOSIS**

As discussed earlier, this is the most difficult step of nasal reconstruction, even for those with experience, as the normal parts of the nose surrounding the missing portion are often distorted and displaced by collagen contraction. Careful study of the deformed nose is required to determine what is missing and what will be required for optimal reconstruction (see Table 1-2).

Nasal defects tend to traverse the face overlapping units and subunits. A congenital hemangioma compresses and displaces the normal cartilages of the nasal tip. Necrosis and collagen contraction displace the alar bases and columella adjacent to the defect and constrict the airways. As a first step the defect should be re-expanded to its original, larger size in the mind’s eye, imagining a contracture of the lip to fall inferiorly and the displaced nasal alae and columella to move laterally and downward. It may be necessary to do a separate preliminary operation to cut away scar, release contractures, and manually move distorted soft tissue and cartilage to accurately assess what must be replaced.

In the case of our present patient, the nasal floor, nasal platform and adjacent facial units were present, so placement of the nose on its platform was easily achieved.
Figure 1-6A-D: Patient is seen as an infant with a large hemangioma present (A). It was partially excised at age four years and later involuted. The patient is seen at age 9.5 years (B-D); her nose is foreshortened and non-projecting, and the nostrils are elongated vertically and open to frontal view.
Chapter 1  When and How to Reconstruct a Child's Nose

OPERATIVE STAGE 1: NASAL LINING, FRAMEWORK AND COVER

Congenital hemangiomas compress and displace the normal alar cartilages. When a hemangio-
ma necroses, collagen contraction shrinks the nasal lining skin and displaces the alar cartilages
posteriorly and superiorly. This lining may be released and expanded.

The plan for our patient was to use the scarred skin of the alae and nasal dorsum as turnover
flaps based on the margin of her nasal airways for lining, build a framework of costal cartilage
for the lower half of the nose, and provide coverage with a form-fitting paramedian forehead
flap. No damaged skin was to be left on the nasal surface. All scarred skin on the surface of
the nose, even only partly scarred skin, was to be used as lining flaps or discarded. Marginal
skin was excised following subunit border lines. The defect borders were made rectilinear
with 90 degree corners so they lay perpendicular to the alar margins and transversely across
the nasal dorsum. These straight borders and 90 degree corners were designed to minimize
the circular character of the wound and thereby minimize trapdoor contraction. The patient's
skin defect occupied the lower nasal dorsum, nasal tip, columella, and the anterior half
of each nasal ala. The skin that remained superior and lateral was normal.

When the scarred nasal skin was lifted off the nose, the alar cartilages were found to be present
and enveloped in the typical leather-like scar tissue of the involuted hemangioma (Figs. 1-7,
1-8). These cartilages were telescoped cephalad over the existing upper lateral cartilages. As
the scar covering these cartilages was excised, the cartilages pivoted inferiorly (Fig. 1-9) and
the nasal lining expanded like the opening bellows of an accordion revealing the existence of
complete lining sleeves for both sides of the nose. The alar cartilages were hypoplastic and the
septal cartilage was recessed posteriorly, yet these structures supported the lining skin of two
capacious nasal lining vaults. This bit of good fortune made it unnecessary to use the turnover
flaps for nasal lining. Therefore, the operative plan was changed. The scarred lining flaps were
discarded. The existing lining sleeves with their intrinsic cartilage support were used to create
new airways.
A dorsal onlay graft was carved to the shape of a nasal dorsum leaving perichondrium on one side of the graft (Fig. 1-13). An 18 x 5 mm flange of perichondrium was left along both edges of the graft (Constantian, 2009). This graft naturally warps toward the side of the perichondrium. To counter this, the perichondrium on the underside of the graft was scored at 8 mm intervals. The graft was fastened firmly to the dorsum of the nose with 4-0 material with the perichondrial side down. Finally, a tip graft (Sheen, 1975) measuring 9 x 12 mm was sutured to the existing middle crura and the columella strut. It projected 24 mm above the plane of the upper lip and 6 mm anterior to the dorsal line of the nose. A cap graft, 5 x 9 mm, was added superior to the tip graft to fill out, or blunt, what would otherwise be a pointed, beak-like nasal tip. This completed the outer layer of the cartilage framework (Fig. 1-14).
The success or failure of the cartilage framework rests on creation of correct shapes and placement of the grafts. The grafts should be designed and assembled with artistry. The finished framework should possess the dimensions and surface shape of a normal, natural nose. Only if the framework is aesthetically correct will the final nose be a success.

**Figure 1-14A-C:** Intraoperative views of the completed outer layer of the cartilage framework (A-C).
Figure 1-15: The forehead flap is designed using a 3-D hemi-pattern that was flattened and opened to represent skin from the entire defect. The elevated flap is rotated 180 degrees for coverage of the nasal defect.
Figure 1-26A-G: Operative steps for late revision to refine the alar grooves and nasal tip subunit (A-E). Intraoperative views of the alar groove refinement procedure (F,G).
Figure 1-27A-D: Patient is seen preoperatively (A, C, E G) and two years following the final operative stage (late revision) (B, D, F, H). (continued on next page)
When and How to Reconstruct a Child's Nose

Chapter 1

45
CHAPTER 2

RECONSTRUCTION OF THE NASAL TIP SUBUNIT
CASE EXAMPLE 1: CLASSICAL RECONSTRUCTION OF THE NASAL TIP

HISTORY

A 6.2-year-old boy lost the tip of his nose when a dog lunged at him over a low barrier and nipped it off. The amputated piece was recovered and reattached within a few hours (Fig. 2-1).

Although the nose tip underwent epidermolysis and the replanted piece appeared lost, the deeper tissues rallied and survived. When I saw him several months later, the nose was healed. The tip was red and hard. The skin and cartilage had survived, but the fat of the nasal tip had been replaced by scar. (Fig. 2-2).

Figure 2-1AB: Patient is seen at 6.2 years following amputation of his nasal tip by dog bite (A) and replantation (B).
Figure 2-2A-D: Patient is seen approximately three months following replantation of the nasal tip after amputation by dog bite (A-D). The tip is red and hard, and the subcutaneous fat has largely been replaced by scar tissue.
Figure 2-7AB: The flap is elevated and inset into the bed of the defect. The forehead wound is closed with moderate tension.
Figure 2-12A-H: Patient is seen preoperatively at age 6.8 years (A, C, E, G) and postoperatively at age 20.3 years (B, D, F, H).
CHAPTER 3

RECONSTRUCTION OF LATERAL DEFECTS OF THE NOSE
Figure 3-17: Following a dog bite, the patient was missing most of the right nasal hemitip, the right soft triangle subunit, ala and part of the right nasal sidewall. The right alar cartilage arch was amputated, and there was a lateral vestibule lining defect 8 mm high. The illustration shows the subunits that are missing.
OPERATIVE STAGE 1: SCAR EXCISION, LINING, CARTILAGE FRAMEWORK
AND FOREHEAD FLAP COVERAGE

The subunit principle was applied to the right nasal hemitip but not to the right alar subunit. Existing scar was excised, wound edges were released and the defect was extended to the borders of the right nasal hemitip subunit. The normal remaining skin of this subunit was excised to the nasal midline. The level of the right alar groove was located from measurements taken on the normal left side and transposed to the right side of the nose. The margins of the defect were extended upward to the alar groove level and laterally, but not all the way to the base of the ala. The important confluence of the nose, cheek and lip was preserved. The defect ended laterally at a vertical line perpendicular to the alar margin. The skin and scar within these subunit and partial subunit borders was used to create nasal lining flaps.

The skin of the right nasal hemitip and partial right ala was turned over like pages of a book to be used for nasal lining. The tracing of the right alar groove was incised and the skin elevated from above down. Two darts were excised from this skin layer creating three turnover flaps; when sutured together they flipped inferiorly and became nasal lining (Fig 3-18).

Figure 3-18: The skin of the right nasal hemitip and partial right ala was turned over like pages of a book to be used for nasal lining. The tracing of the right alar groove was incised and the skin elevated from above down. Two darts were excised from this skin layer creating three turnover flaps; when sutured together they flipped inferiorly and became nasal lining.
Existing surface scars were not used. A new incision was made on unscarred skin along the marked line. The skin above was elevated with 3.5 mm of fat for a distance of 1.2 cm. The skin below the incision was elevated for 7 mm. No skin excision was needed. Using fine scissors, the planes of the sidewall, the alar lobule and the alar groove itself were carved out of the deep scar and fat of the nose. The lower flap was anchored in the newly created alar groove with 5-0 permanent buried sutures. A few quilting sutures, lightly tied so as not to blanch the skin, held the sidewall flap to its bed and prevented hematoma. The superior skin flap was closed to the inferior skin flap with interrupted 6-0 sutures. The nose appeared symmetric on the operating table (Figs. 3-26, 3-27)

**Figure 3-26:** An incision is made in the border between subunits (subunit partition) in a line of deepest shadow on the nasal surface. The sidewall and ala are sculpted. The inferior flap is anchored to the alar groove, and the superior flap is secured to the inferior flap.
Figure 3-30A-H: Patient is seen preoperatively at age 13.2 years (A, C, E, G) and postoperatively at age 18.6 years (B, D, F, H) (continued on next page).
Reconstruction of Lateral Defects of the Nose

Chapter 3

139