

COMPLICATIONS OF SEPTUM SURGERY

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In the evaluation of septum surgery the term "complication" should be defined broadly enough to account also for the failure to achieve normal nasal function in general, rather than to deal strictly with misadventures during and immediately after surgery. A comprehensive concept of complications has to include the consequences of omission as well as of commission and has to cover a long post-operative time to include late problems. Awareness and understanding of the possible unfavorable factors will give the best protection against the shortcomings of the desired results. Since nasal function is very significantly influenced by the general condition of the patient as well as by the local problem, it is mandatory that the pre-operative and the post-operative evaluation considers the patient in his totality and also considers the local problem in its total ramification rather than to limit the attention to the septum as an isolated structure.

The following outline will briefly describe factors that might interfere with the desired restoration of normal nasal function.

I. Medical considerations (pre-operative and post-operative)

A. Systemic problems

1. Diabetes
2. Lues
3. Tuberculosis
4. Cardiovascular problems, including hypertension and hypotension
5. Blood disresia
6. Fragility of blood vessels
7. History of bleeding tendency with negative findings
8. Vitamin K deficiency
9. Anticoagulant and Aspirin medication
10. Steroid medication
11. Hormonal changes in general
12. Malignancy
13. Pregnancy
14. Emotional disturbances in their general manifestations
15. Changes of nasal reflexes

B. Local problems

1. Acute and chronic nasal and paranasal sinus infections. (Timing; antibiotic coverage; limitation of surgery; or surgery in 2 steps will have to be considered.)
2. Allergic rhinitis. (Pre-operative hyposensitization treatment; selection of allergy-free- interval; steroid and antihistamine coverage.)
3. Endocrine changes. (f.i. hypothyroidism, gynecological change, including pregnancy.)
4. Vasomotor changes, including habituation to nasal vasoconstrictors; Rauwolfia medication.

5. Nasal manifestations of emotional disturbances.
6. Fatigue and chronic nervous exhaustion.
7. Dietary indiscretions.
8. Nasal sensitivity to smoking.
9. Nasal sensitivity to environmental factors. (Dust; dryness; excessive humidity.)
10. Chemical exposure. (Local)
11. Foreign bodies.
12. Primary and secondary atrophy of the nasal mucosa and the nasal skeleton.
13. Hypertrophy of the turbinates and changes of the position of the turbinates.
14. Excessive enlargement of the lymphoid tissue over the vomer.
15. Local tumors.
16. Traumatic (Digging).

II. Diagnosis

In order to ensure satisfactory result, the diagnosis has to be complete and must include all the structures of the nose.

The diagnosis should be continuously reviewed, particularly under anesthesia and during the operation after freeing of the individual structures. Findings might change drastically. Deflections will, at times, correct themselves after being freed from the soft tissue covering; othertimes, the pathology may become accentuated, requiring considerable extension of the surgery. It is particularly important to recognize tension of the septum and the associated structures. Tension can produce considerable problems during surgery and especially in the post-operative course. Some techniques of septum surgery will not reveal tension of the nose. Cottle's maxillary-premaxilla approach is best suited to uncover tension and allow extension of the surgery to any part of the nose. The diagnosis should consider:

1. Nasal pyramid and nostrils in general, in relation to the face and to the nasal septum.
2. Vestibule
 - a. Ala and lower lateral cartilage (pinched-in, collapsed, stiff, ballooning)
 - b. Columella
 - c. Mobile septum
 - d. Caudal end of septum (often not considered in some techniques)
 - e. Os internum
 - f. Pyriform aperture, maxillary spine
 - g. Nasal valve (level of attachment; changes of the cartilage; relation to the septum deflection; valve can be made worse after moving the septum)
 - h. Upper lateral cartilage, including valve
 - i. Cul-de-sac
3. Septum (cartilagenous and bony)
 - a. In relation to the soft tissue structure; tension
 - b. In relation to the valve
 - c. In relation to the turbinates and the lateral wall in general
 - d. Atrophy or hypertrophy of the mucosa
 - e. Atrophy or hypertrophy of the skeletal parts
 - f. Impactions of the septum (particularly posterior; often unrecognized)
 - g. Adhesions to the lateral wall and the valve
 - h. Scars
 - i. Missing parts (cogential, post-traumatic, post-operative)
 - j. Lymphoid pad over the vomer
 - k. Choanal atresia

4. Turbinates

5. Limitations

- a. Obligatory mouth breather
- b. High-arched palate with its impairment of the air space

III. Surgical considerations:

A. Anesthesia

1. Pre-operative medication

It is important to have a reasonably calm patient. Barbiturates have to be given to counteract possible adverse reaction from the local anesthesia. They will also facilitate general anesthesia. The dosage is influenced by previous or current medication of the patient. Adverse reactions to drugs in the past should be determined. I prefer to start intravenous fluids prior to surgery. This allows immediate medication as the need arises.

2. Local anesthesia

Local anesthesia is preferred, since it produces a drier field, which allows more meticulous handling of the structures. The agents to be used will depend on the personal choice of the surgeon. Care must be taken to avoid tissue irritation and permanent interference with the function of the ciliated epithelium. Several problems have been seen:

- a. Vasospasm, which may produce blindness. This is rare and usually temporary. Vasodilators (f.i. papaverine) are helpful.
- b. Adrenalin shock: One drop of the anesthetic agent which contains adrenalin, is injected into the tissue. A waiting time of two minutes is allowed, before proceeding with the remaining injection. The waiting time gives the organism a chance to adjust to the sudden exposure to adrenalin.
- c. Inadvertent injection of adrenalin.

The containers, with the different solutions, should be well marked. Adrenalin should always be kept in a significantly smaller cup, than the solution for injection. It is helpful to place an identifying object in the different containers. If injection of adrenalin has been made, incision of the tissue will reduce the absorption. Phentolamine (regitine, 5 mgs., intravenous, for adults) will shorten the sympathetic effects. Hypertension and cardiac distress may be relieved by priscoline (10 to 50 mgs., or more; subcutaneous, intramuscular or intravenous). Tremors and convulsions will respond to pentothal or nembutal, intravenous. Pulmonary edema will respond to oxygen under pressure.

- d. Inadvertent injection of cocaine.

Topical anesthetic agents should always be kept on a different table from injectables and should also be well marked. It is good practice to have topical solutions colored (usually pink) to call immediate attention to its limited use. The use of cocaine flakes will eliminate this misadventure and also retard absorption in topical use. Incision, barbiturates, artificial respiration and cardiac massage might be required.

- e. Convulsions are not expected when the patient has had adequate medication.
- f. Restlessness is occasionally seen. It responds well to the use of oxygen (5 to 10 liters/minute).
- g. Vomiting is rare and will usually be controlled by medication like compazine, marezine, tigan, phenergan, etc.

3. General anesthesia

This is used when surgery is done in children. Some surgeons employ general anesthesia routinely with additional injection of the local field. Problems seen with general anesthesia:

- a. Same as in general surgery; particularly involving circulation and respiration.
- b. When additional injection is used, most problems that were listed under local anesthesia will also be applicable here.
- c. Increased bleeding: obscuring the operative field.
- d. Vomiting and aspiration.
- e. Respiratory difficulty in the post-operative recovery period. The air way has to be kept in place for longer period of time due to the nasal packing. Extra help for supervision is required.
- f. Intubation granuloma.

B. During surgery

1. Due to omission

- a. No attempt to restore normal anatomy.
- b. All diseased portions of the septum were not reached and corrected or were not considered.
 - 1. Loss of skeletal elements not considered.
 - 2. Pre-existing scarring not considered.
 - 3. Caudal end of the septum not considered.
- c. Pathology of associated structures not corrected or not considered.
 - 1. Maxillary spine, premaxilla, pyriform aperture.
 - 2. Lower lateral cartilage, tip, alae, columella.
 - 3. Upper lateral cartilage, including valve and cul-de-sac.
 - 4. Nasal bones.
 - 5. Turbinates.

2. Due to commission

- a. Incision too far posterior.
 - 1. Scar in mucosa with interference of ciliary movements.
 - 2. Visualization of structures made difficult.
 - 3. Uncovering of structures more difficult.
- b. Incision too far anterior.
- 2. Post-operative scarring - frozen tip.
- c. Dissection not strictly under the periosteum.
More common in a nose that has been exposed to repeated trauma. Reaffirm the proper level of elevation constantly. Elevation in an improper level will interfere with circulation and may lead to atrophy and late perforations.
- d. Elevation of the mucoperichondrium has to be sufficient to allow for adjustment of the soft tissue after correction of the cartilage or bone has been completed.
- e. Bleeding
 - 1. Incision.
 - 2. Maxillary crest
 - 3. Vomer.
 - 4. Associated structures.

Recognition of a bleeding structure is important to prevent post-operative hematoma. The intraseptal space should be carefully inspected after the pack is removed from the nasal cavity and before recon-

struction of the septum has started. Soft tissue bleeders are controlled with compression, injection, cautery and dessication. Monsel solution is also employed. Bleeding from bone vessels is handled by compression, with a blunt instrument, of the bony canal surrounding the blood vessel. Bone wax and Gelfoam are employed when compression is not effective. If cotton or gauze was used for compression in the intraseptal space (this is best not done), the space has to be inspected with magnification to ascertain the complete removal of any cotton fiber, to avoid a possible cotton-granuloma. Packing of the nasal cavity has to be sufficient in the area of the bleeder, but must not be traumatic to the mucosa. It is best to pack first temporarily and place the final pack at the termination of the surgery.

General medication like vitamin K, premarin, koagamin, topical thrombin can be very helpful. It is important to have the patient reasonably calm and additional sedation should be given through the intravenous drip, as needed. When surgery is done under general anesthesia, hypotension can be induced. It is however, very important to check the field carefully after normal blood pressure has been restored.

f. Perforation

Perforations will interfere with the circulation and should be sutured as soon as possible. Early repair will limit the size of the perforation. At the time of the reconstruction of the septum, bone or cartilage should be placed at the site of repair even if there is no perforation of the opposite mucoperichondrium. The proper pre-operative evaluation of the nasal mucosa will often be helpful in avoiding perforations. An atrophic mucosa is obviously more vulnerable and apt to perforate. The mucosa over an impaction is usually thin and may easily perforate. In these cases, it is advisable to push the cartilage, with the soft tissue still attached, to the opposite side, to relieve tension, before attempting to elevate it. Other times, it is best to sever cartilage and bone around the impaction, leaving it attached to the soft tissue for later removal.

- g. Sagging of the dorsum during surgery is usually indicative of old trauma with tension of the tissue. If the sagging is not severe, undermining of the nasal dorsum can be done through the hemitransfixion incision and cartilage implants (preferably crushed cartilage) can be placed to the affected area. If the sagging is more pronounced undermining of the dorsum is done through the intercartilagenous incision or possibly a rim incision, depending on circumstances.
- h. Twisting of the cartilagenous portion of the nasal pyramid after freeing of the cartilage is the result of scar traction. It will require extension of the septal surgery and employment of reconstructive procedures.
- i. Swelling of the soft tissue of the face and the nose during surgery will respond well to the use of ACTH, steroids or local and systematic hyaluronidase. This treatment is particularly helpful when the nasal structures are obscured by considerable swelling after accidents. If the patient has been on steroids within 6 months prior to surgery, he should be given steroids routinely. Needless to say, antibiotic coverage should be provided when steroids are employed.

C. Post-operative

a. Immediate

b. Late (up to 10 to 20 years)

1. Packing

a. Too loose

- 1. May fall into the nasopharynx and produce cough and gagging. Must be removed and replaced.

2. May come out in front. Pack may be shortened or better replaced.
 3. May encourage bleeding into the intraseptal space as well as the nasal cavity.
 4. May not give sufficient support to the intraseptal implants. They may fall to the floor of the intraseptal space.
- b. Too firm
 1. May produce abrasions and lead to adhesions.
 2. May force structures apart when associated structures have been included in the surgery.
 - c. Packing placed into the incision.

This will produce distortion, prolong time of healing and encourage infection. If this situation is encountered, repacking of the nose will be necessary. The best protection is to suture the incisions after surgery has been completed.
 - d. Allergic reaction to the material of the pack or the medication.
2. Bleeding
- a. Septal mucosa
 - b. Turbinates
 - c. Intraseptal
 - d. From associated structures
- Bleeding into the intraseptal space or the facial tissue will require aspiration, or if the blood is already organized, incision and evacuation will be needed. The cause of the bleeding should be determined and removed.
3. Infection
- a. Intraseptal space
 - b. Nasal cavity in general and upper respiratory tract.
 - c. Paranasal sinuses
 - d. Ears
- The offending organism should be determined as promptly as possible and an appropriate antibiotic should be given. Drainage should be established. The pack might have to be removed.
4. Allergy of the nasal cavity
- a. Activation of a latent allergy, that was not recognized, or was not recognizable before the surgery.
 - b. Activation of nasal allergy in a patient who has had successful desensitization treatment when surgery is done in his main allergy season.
 - c. Allergy to packing material or to medication.

Coverage of the patient with antibiotics and steroids will keep the symptoms under control; desensitization treatment should be given or resumed, if needed. A careful personal and family history will often suggest the possibility of allergy. Pre-operative and post-operative eosinophile counts will also give an important lead.
5. Post-operative swelling of the nose and the face.
- a. Consider allergy to tape (seal skin; non-allergic tape)
 - b. Patient may be a reactor in general (sedation: steroids; enzymes)
 - c. Vitamin-K deficiency

In addition to the use of steroids, enzymes, antihistamine, the administration of heparin should be considered.
6. Prolonged infiltration of the nasal tip.
- This may occur in spite of gentle tissue handling. It responds to heparin, steroids and enzymes.
7. Structural changes.
- a. Septum

1. The septum returns to the old position. This happens when the spring of the cartilage was not completely broken or when tissue tension was not completely relieved
2. Difficulty with the implants in the intraseptal space.
 - a. Shifting and twisting. This is due to improper placement or packing
 - b. Implants fall to the floor of the intraseptal space. This is caused by improper packing
 - c. Rejection of implants. This may happen when bleeding or infections are encountered or when sharp spicules of the bone implant press against the soft tissue and produce a perforation
 - d. Curling of the cartilage when the spring was not broken.
 - e. Shift of the caudal replacement; may be due to traction of the sutures
 - f. Cartilage may grow in the intraseptal space and produce thickening of the septum in toto. Two or three septa might be found in these cases. This will require simple removal of the supernumeral septum
 - g. When bone or cartilage is used, it should be ascertained that the implant has not been stored in formalin or alcohol. Considerable tissue reaction may result. Early removal of the implant and the use of steroids and enzymes is required.
3. No replacement of the cartilage or bone into the intraseptal space may result in:
 - a. Atrophy of the soft tissue
 - b. Late perforation
 - c. Flaccid septum, which will "flutter" with respiration and is very annoying to the patient
 - d. A soft septum will lead to subsequent enlargement of the turbinates and will annul the initial result. Turbinates require a firm terminus for proper function. To remedy these problems, implants into the intraseptal space are needed.

b. Sagging and saddling of the cartilagenous pyramid and retraction of the columella.
 This is primarily due to loss of support and unrecognized scar traction or tension in the tissue. It is also seen after infections in the intraseptal space. To prevent these possibilities, replacement of the structures, elimination of tension in the tissue, insertion of crushed cartilage to the dorsum to influence scar formation and prompt antibiotic treatment and drainage of infections is needed.

 - c. Change of the nasal valve.
 By moving a deflected septum back to midline, a previously normal valve may become pathologic. Special attention at the end of the septum surgery should be given to this possibility. Correction will require extension of the surgery to the upper lateral cartilage.
8. Other problems.
 - a. Paraffinoma: when paraffin-containing preparations are used on the dressing.
 - b. Cotton-granuloma; when cotton fibers are inadvertently inserted into the intraseptal space.
 - c. Not all packing removed.
 - d. Synechiae; watch for erosions of the mucosa after removal of dressing. Inspect, daily if necessary. Sever adhesions and use surgical or similar preparations or plastic sheeting.
 Firm packing may push the turbinates laterally and also produce
 - e. Wide air space.

This may be due to nasal atrophy that was not recognized pre-operatively. Firm packing may push the turbinates laterally and also produce wideness of the air space. Relocation of the turbinates or Cottle ozena operation may be required.

- f. Tape marks, especially of the ala rim. Avoid uneven application of tape. If the patient complains of pain, the dressing should be removed and replaced.
- g. Necrosis of skin, either due to injury, infection or allergy. Check the affected region if the patient complains.
- h. Accidental burn of the nasal bandages from smoking or lighting of cigarettes.

Fortunately complications are not common and in most instances are not severe. The knowledge of the basic principles of septum surgery, impeccable technique, understanding of the total problem of the patient and the knowledge of the possible complications and their remedies, will lead to a high percentage of very satisfying results.

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