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Nerve Injuries During Rhytidectomy. Considerations After 3,203 Cases

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Abstract. The potential for injury to the nerves of the face is ever-present in rhytidectomy. Only a thorough knowledge of the anatomy of the face, adequate surgical experience, and strict adherence to basic operating principles can avoid problems. The temporalis, paraorbitalis, genian, mandibular, and cervicoauricularis areas each offer hazards, which are detailed in this discussion, along with some technical details to avoid both temporary and permanent damage.

Key words: Rhytidectomy — Nerve injury

Nerve injuries after rhytidectomy are an underestimated occurrence. A complete facial paralysis cannot be overlooked, but the little damages caused by injuries to small motor or sensory branches are often neglected in the statistical reports, because most of these lesions recover spontaneously within a few months [4] and because many surgeons consider them a normal and inevitable consequence of facial surgery.

The aim of this paper is to pinpoint and summarize these dangers, which if overlooked, can bring about temporary paresthesia, hypoesthesia, anesthesia, painful neuromata, and temporary or permanent paralysis that could spoil the result of a well-performed procedure.

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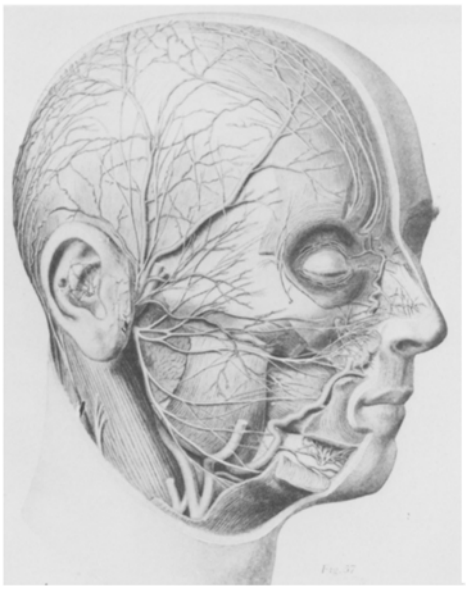


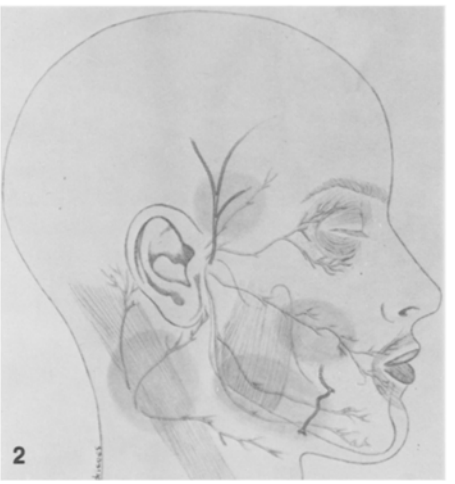
Fig. 1. Superficial nerves of the face [18].

Anatomic Considerations

The anatomic areas involved in a usual face-lift procedure could be artificially divided into five regions: temporalis, paraorbitalis, genian, mandibular, and cervicoauricularis. Each area represents a danger to the surgeon and only deep knowledge of the anatomic details (Figs. 1, 2), adequate surgical experience, and strict adherence to basic operating principles can avoid problems [3].

Temporalis Region

In this area, problems arise primarily with the the temporofrontal branch of the facial nerve, the anatomic variations of which are a real hazard to the surgeon. Like the other branches of the seventh nerve [7, 20], the temporofrontal branch varies in number and disposition of its rami, but its direction is constant. The course projected on the skin is represented by a line starting from a point $^1/_2$ cm below the tragus in the direction of the lateral extremity of the eyebrow, passing $1^1/_2$ cm above the lateral extremity of the eyebrows (Fig. 3) [13]. Another landmark that could help the surgeon in estimating the location of this branch is the frontalis ramus of the superficialis temporal artery which, at the level of the lateral border of the frontalis muscle, offers a descendant branch to the muscle that generally coincides with the deepening of the nerve in the muscle. The insufficiency of the subcutaneous mass at the level of the lateral border of the frontalis muscle makes the temporofrontalis branch superficial and vulnerable. A valuable precaution to avoid injuries to this nerve, especially when a wide



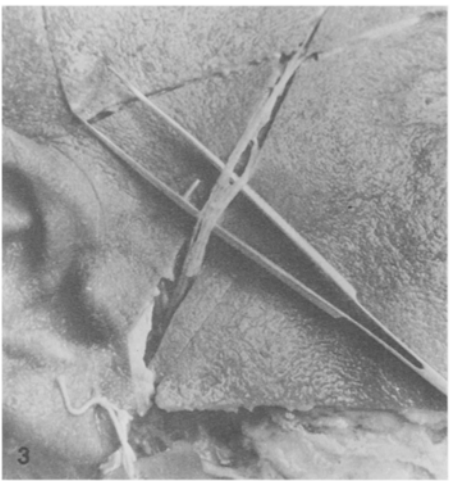


Fig. 2. Schematic drawing of the most commonly injured nerves during face-lifting procedure with most frequent sites of injuries

Fig. 3. The trajectory of the temporofrontal branch projected on the skin. Reprinted from *Plast Reconstr Surg* 38:352, 1966 by permission

undermining of the scalp area or of the forehead is to be carried out, is to conduct a subaponeurotic dissection in the plane above the frontalis branch of the superficial temporal artery and to follow a subaponeurotic plane of cleavage when passing below this level (Fig. 4) [13]. Furthermore, the subaponeurotic undermining in all its extension above the frontal branch allows for better protection of the pilous follicles, easier dissection, and less bleeding.

The dangerous zone within which the nerve could be injured actually constitutes an area greater than a simple pedicle. During a secondary face-lifting, this area often presents a certain amount of fibrosis that disguises the anatomic details and increases the risk of injury by dissection or thermocautery. Fortunately, the temporofrontal nerve is largely formed by several rami, which explains why injury to a single branch is not always followed by monolateral paralysis of the frontal muscle. Only if the injury is extended to more branches does a real effect on the musculature become evident (Fig. 5).

Paraorbitalis Region

The orbicularis oculi muscle represents the structure of primary concern in this area (Fig. 6). The innervation of this muscle is by branches of nerves originating from the facial nerve. These branches are variably anastomotic [5] and penetrate the muscle from its deep aspect (Fig. 7) [7]. Due to these multiple anastomoses, which form a periorbitalis plexus, there is little danger of compromising the innervation of this muscle during face-lift surgery. If the undermining follows the right plane, these nerve branches will remain undisturbed in the deep subcutaneous tissue when the flap is raised.

Fig. 4. The two planes of dissection: subaponeurotic, above the pedicle containing the temporofrontal nerve, and supra-aponeurotic, below it. Reprinted from *Plast Reconstr Surg* 38:352, 1966 with permission

Fig. 5. One year after rhytidectomy, this patient shows monolateral paralysis of the frontal muscle due to injury of the temporofrontal branch of the facial nerve

Genian Region

The danger in this area lies in the buccal and zygomatic branches of the facial nerve. After their exit from the parotid gland, these branches run superficially to the external surface of the masseter muscle; about 2 cm posterior to its anterior border, they superficialize, innervating the peribuccal muscles.

Damage of these nervous structures often occurs in an area delimited superiorly by the inferior border of the zygomatic arch, inferiorly by the superior border of the mandible, and posteriorly by the anterior border of the masseter muscle. In this area several small cutaneous arteries cross the subcutaneous tissue, passing from a deep to a superficial plane; their trajects are per-

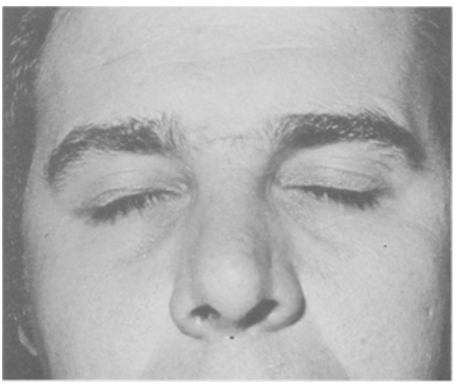


Fig. 6. Weakness of periorbital musculature due to a previous surgical rhytidectomy

Fig. 7. Anatomic dissection of facial nerves showing the multiple anastomotic branching of the rami

pendicular to the usual plane of cleavage followed by the surgeon in the undermining of this area [15]. Severance of these arterial branches is followed by bleeding that often needs meticulous and repeated thermocauterization, which, if not accurately controlled, could injure these nerve branches (Fig. 8).

Mandibular Region

During the undermining of the mandibular area, an important landmark is the platysma muscle. This thin muscle has its caudal insertion on the deltoid pectoralis fascia and on the clavicle; superiorly, it ends with attachment to the deep aspect of the skin over the chin area. It intermingles with the quadratus menti and the triangularis oris fibers, thus covering almost the whole perimandibular area that is usually undermined in a face-lifting procedure.

Table. 1. Incidence of paralysis of one or more nerves after rhytidectomy as reported by several authors.

Year	Author and reference	Number of operations	Paralysis—% of total	Branches involved[a]
1970	Conway [6]	325	0.6	Temporal—2 Temporal—2
1971	McGregor, Greenberg [12]	524	2.6	Buccal—1 Mandibular—3 Spinal accessory—4
1972	McDowell [11]	105	2.0	Mandibular—2
1976	Stark [19]	500	0.4	Temporal—2 Temporal—5
1977	Baker et al. [1]	1,500	0.5	Zygomatic—1 Mandibular—2
1977	Leist et al. [9]	324	1.0	Temporal—3
1978	Thompson, Ashley [21]	922	0.7	Unspecified—6
1979	Pitanguy [16]	3,203	0.1	Temporal—3

[a]Injuries to sensory branches are not included.

The nervous structure with greatest potential for injury in this area is the mandibular nerve. Its course can be divided in two segments in relation to the facial artery [8]. Posterior to this vessel, the nerve passes, in 81% of patients, above the inferior border of the mandible, being in the other 19% of patients below it, but not lower than 1 cm from it. Anterior to the facial artery, it passes above the superior border of the mandible. Although some branches of nerves may be thought to be mandibulary branches, Dingman and Grabb [8] have shown that any nervous structure anterior to the facial artery that runs below the border of the mandible innervates the platysma, even if the branch is anastomotic with the true mandibular nerve. Therefore, a dissection respecting this precious landmark should be safe. Sometimes, this muscular structure is relatively thin, especially in older people, and if the surgeon is dealing with a secondary or tertiary rhytidectomy, this thin muscle could be barely definable in some areas due to fibrous degeneration, partial laceration, or removal during the previous procedures. In the midline area of the neck, so often involved in the correction of the turkey-gobbler deformity, it is also common to find a diastasis of the platysma muscle that would deprive the surgeon of this important landmark. Therefore, it is important to keep in mind that the palpation of the facial artery is a simple maneuver useful in designating a line of division between a dangerous area (posterior to it) and a relatively safe area (anterior to it) (Fig. 9) [1].

Cervicoauricular Region

The anatomy of this region is characterized by the presence of several important nervous structures, namely, the auricularis major, the small occipital, and

Fig. 8. Six months after a face-lifting procedure, this patient shows weakness of peribuccal muscular system due to injury of the buccal rami of the facial nerve

Fig. 9. Four months postoperatively. Loss of function of the depressor of the lip caused by injury of the mandibular nerve during a face-lift procedure

the transverse cervical nerves. The three of them originate from the superficial cervical plexus. The auricularis major crosses posteriorly and inferiorly from the sternocleidomastoideus muscle and terminates in several branches that innervate primarily the earlobe and the retroauricular area. The small occipital nerve ascends along the posterior border of the sternocleidomastoideus muscle to innervate the area covering the mastoid. The transverse cervical, after contouring the posterior border of the sternocleidomastoideus, crosses the anterior surface of this muscle, passing underneath the external jugular vein and innervates mostly the skin over the hyoid bone.

In an area 4–5 cm below the mastoid, all these nerves are contained in the superficial cervical fascia that sheathes the sternocleidomastoideus muscle (Fig. 10). The fascia at this level is poorly defined and the undermining, unless very carefully performed, could easily lacerate the dense cellular tissue and damage these nerve branches [10]. Furthermore, at the base of the earlobe, where the terminal branches of the auricularis major become superficial, innervating the skin of the ear, the usual retraction exerted by the surgeon during the perilobular incision could also lead to injury to these nerves [18]. The avoidance of this maneuver and an accurate, sharp undermining in a superficial subcutaneous plane of cleavage prevents damage to these structures.

Another important nerve appertaining to this area is the spinal accessory.

Fig. 10. An area 4–5 cm below the mastoid is where the great auricular nerve is most commonly injured

After its exit from the cranium, the external branch of the spinal accessory nerve contours the internal aspect of the sternocleidomastoideus muscle giving some fibers to it, anteriorly to posteriorly and, going downwards, joins its posterior border, four fingerbreadths below the earlobe going finally to innervate the trapezius muscle. A blind undermining in the cervical area could penetrate the muscle or lacerate its posterior border, thus injuring this nerve, compromising the motion of the trapezius, and resulting in flaring of the wing of the scapula.

Conclusion

In this discussion of potential facial nerve injury, we have dealt with only the most widely used face-lifting technique. There are, of course, collateral procedures frequently performed in association with the routine rhytidectomy, as well as other techniques of face-lift. Each additional procedure increases the risk of damage to the nerves, and any variation in procedure may bring about different ways in which nerves can be damaged. Such procedures should only be done by an experienced surgeon, so that a purely cosmetic operation does not become a source of serious problems for the patient.

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