

THE FRONTAL SINUS SURGERY HISTORY

A. Macchi¹, M. Bignami²

Ent Department Asst Settelaghi-Varese, Insubria University Varese Italy

1. Ent Department Asst Settelaghi-Varese, Insubria University Varese Italy. Upload Center University of Insubria Varese

2. ¹Division of Otorhinolaryngology, Department of Biotechnology and Life Sciences, University of Insubria, Varese, Italy. Department of Otorhinolaryngology, ASST Lariana, Como, Italy Head and Neck Surgery & Forensic Dissection Research center (HNS&FDRc), Department of Biotechnology and Life Sciences, University of Insubria, Varese, Italy.

Corresponding Authors

Alberto Macchi,

Via Guicciardini, 9 21110 Varese

Report

The earliest evidence of knowledge of the paranasal sinuses and probable early surgical nose and paranasal sinus procedures date back to between 3700 and 1500 BC., as recorded in Edwin Smith's papyrus. It was written about 1500 BC and a detailed description of the anatomy of the paranasal sinuses is given, as also surgical procedures to treat pathologies of the paranasal sinuses. This paper is kept at the New York Academy of Medicine. The ancient Egyptians certainly were able to perform surgical treatments on the sinuses; there is evidence of operations in patients with nasal polyposis.

From an etymological point of view, the Latin word "sinus" represents the geographic term indicating a gulf, a creek or a bay, while the Greek lemma ἄντρον (ántron) is translated with "cave, cavern".

In the Hippocratic Corpus (460 – 377 BC), we found therapeutic indications for sinonasal polyps, while Aulus Cornelius Celsus (ca. 14 BC – ca 37 AC) extensively describes the However, we need to go back to the 1700s to have accurate descriptions of the first surgical

anatomy of the paranasal sinuses in the 6th and in the 7th books of his treatise "De medicina". procedures on the frontal sinus, by trephination, in particular it was Runge who performed the first surgical procedure in 1750.

The first scientific publication was in 1870 by Wells who described the surgical procedure performed on the frontal sinus for the presence of a mucocele in a detailed way. He described the first intracranial drainage procedure using an external access with a tube.

In 1884 Alexander Ogston described a trephination procedure through the anterior wall of the frontal sinus to evacuate a frontal abscess. The procedure involved an apposition of a drain at the level of the frontal sinus duct. This method, however, did not achieve great popularity because of the high number of failures due to stenosis of the frontal duct.

Surgical treatments of frontal sinus pathologies have been described since the 19th century, however, while representing a

small part of sinus surgery, they have always represented a tricky approach. One of the mainstays is the preservation of the nasofrontal duct, which unfortunately in the postoperative period represents one of the most frequent recurrences.

In the years 1884 to 1894 Ogston and Liuc and later Schonborn and Breiger published the first descriptions of frontal sinus osteoplasty surgeries, in which the various surgical steps were illustrated.

In 1854 Macbeth performed an osteoplastic flap, removing the mucoperiosteal lining, and allowing the sinus to fill subsequent osteogenic activity. He published a series of cases with 93% success.

In 1895 Kuhnt and later Riedel and Schenke in 1898, described the removal of the anterior wall of the frontal sinus in order to beat the disease. The mucosa was stripped to the level of the frontal recess, and a stent was placed for temporary drainage.

In 1903 Killian described a modification of the Riedel-Schenke procedure to minimize the cosmetic deformity provoked. He recommended preserving one centimeter of the supraorbital rim, an ethmoidectomy with rotation of a mucosal flap into the frontal recess with stenting to prevent stenosis. Unfortunately, the most frequent complications were high incidence of late morbidity with restenosis, supraorbital rim necrosis, postoperative meningitis and mucocele formation.

In 1905, the first conservative procedures began to be performed to manage the significant cosmetic deformity as well as the high failure rate of the ablative external procedures. This period consisted of intranasal approaches to the frontal sinus with an external approach. This procedure consisted of an incision in the medial periorbital of the frontal process of the maxilla, the lamina papyracea are removed. They removed the frontal sinus floor and

cured the mucosa then a stent was placed in the frontal ostium to maintain communication and ventilation.

The most serious complications were restenosis and recurrent infection.

One of the most important problems of these procedures were the restenosis and recurrent infections. Also a medialization of the orbital soft tissue, as described by Boyden, was the result of the procedure on the lamina papiracea, and due to frontal narrowing with scarring and stenosis.

These techniques had a failure rate around 33% of the cases.

Even Sewall, Boyden and McNaught in 1935 published their patients' result with 30% of failure.

In 1958 began the era of the osteoplastic anterior wall approach to the frontal sinus. The first ones were Brieger , Schoenborn, Winkler and later Beck who described the methodology .

In 1958 Goodale and Montgomery published the first work on osteoplastic flap with an excellent success rate. Intranasal probing and attempted enlargement or cannulation of the nasal frontal orifice are mentioned only to be condemned. The authors considered that once the virginity of the nasofrontal passage has been violated, scarring and stenosis are inevitable and were the main causes of failure. Hardy and Montgomery were the first to publish the first results of their frontal sinus surgeries with an average follow-up of three years and success in 95% of cases. The osteoplastic flap frontal sinus obliteration procedure popularized by Montgomery in the 1960s has historically been accepted as the gold standard for treatment of frontal sinus disease. The main impetus for developing this technique was the high failure rate associated with earlier external techniques such as the Lynch and Lothrop procedures, which produced short-term patency rates up to 90% but failed at least an additional 20% over a

seven-year follow-up period. This led to the prevailing dogma in the otolaryngology specialty that trauma to the mucosa of the frontal recess inevitably leads to scarring and obstruction of the frontal sinus outflow tract.

Later, in 1997 Wide et al reported a rate of in 62% of success rate of patients with further success in 21% in patients undergoing surgical revision of the first treatment.

Schaefer and Close were the ones who published a case series of 36 patients with pathology at the level of the frontal sinus and described their technique. Their procedures included an endoscopic and microscopic techniques, the results of their group of patients were in 12 patients a complete resolution of the problem while in 11 patients only improvement in symptoms is reported as a reduction of the numbers of recrudescence.

The real breakthrough in frontal sinus surgery came with Draf in the early 1990 years.

In 1991 Wolfgang Draf, MD, first described a series of extended procedures to sequentially open the frontal sinus outflow tract more widely. The most extensive of these procedures was known as the Draf III and involved the creation of a common frontal sinus cavity. In 1995, Charles Gross, MD, further defined the Draf III as it is currently known, the endoscopic modified Lothrop

Draf used both a microscope and an endoscope to perform intranasal fronto-ethmoid surgery for frontal sinus disease. The Draf procedure were aimed at opening the frontal ostium intranasally and allowing the sinus to drain. In 1991, he developed three types of approaches; the first Draf I consist of and anterior ethmoidectomy with opening of the nasofrontal duct (NFD); Draf II in addition consists of unilateral resection of the floor of the frontal sinus while the type III is a bilateral resection of the frontal sinus floor. During the years, he published articles citing a 90% of success rate.

Since then, various modifications of Draf's method have been proposed, defining a continuous development of the surgical method over the past three decades.

With the advent of the endoscope era, this instrument simplifies the opening of the frontal sinus ostium and a direct way of drainage of the frontal sinus. The advantages of such technique include a lower morbidity rates, a shorter hospital stay, a less invasive procedure, and no external scarring.

Kountakis and Gross in 2003 reported on longterm results of the modified Lothrop procedure. The modified Lothrop procedure or frontal sinus drill-out is a completely intranasal technique that creates a common frontonasal communication to allow drainage and ventilation of the chronically infected frontal sinus. It is an effective alternative to the classic frontal sinus obliteration. They noted that with advancement of instrumentation and improved skills of surgeons with endoscopic procedures, success has been similar to that of the open osteoplastic approach with obliteration.

Stankiewicz and Wachter in 2003 reported a 90% success rate with the endoscopic approach for patients who had an osteoplastic approach and then failed.

The future is based on new technologies and a more capacity to a early diagnosis can improve the treatment of the pathology

Reference

Hassam H. Ramadam. History of Frontal Sinus Surgery

Beck, JC (1916) External frontal sinus operation. JAMA 67 :1811–1815

Becker D, Moore D, Lindsey W, et al (1995): Modified trans nasal endoscopic Lothrop Procedure: Further considerations. Laryngoscope 105 : 1161

- Boyden GL (1952) Surgical treatment of chronic frontal sinusitis. *Ann Otol Rhinol Laryngol* 61 : 558
- Brieger (1895) Ueber chronische Eiterungen der Nebenhöhlen der Nase. *Arch Ohren Nasen Kehlkopfheilk* 39 : 213.
- Brown, JM (1946) Frontal sinusitis. *Trans Amer Laryngol, Rhinol And Otol Soc* 50 : 314–317
- Close LG, Lee NK, Leach JL, et al (1994) Endoscopic resection of the intranasal frontal sinus floor. *Ann Otol Rhinol Laryngol* 103 : 952–958
- Coakley CG (1905) Frontal sinusitis: Diagnosis, treatment, and results. *Trans Am Laryngol Rhinol Otol Soc* 11 : 101
- Dedo HH, Broberg TG, Mur AH (1998) Frontoethmoidectomy with Sewall-Bowden reconstruction: Alive and well, a 25-year experience. *Am J Rhinol* 12 : 191
- Donald PJ (1995) Surgical management of frontal sinus infections. In Donald PJ, Gluckman JL, Rice DH (eds): *The Sinuses*. New York, Raven Press
- Draf W (1991) Endonasal micro-endoscopic frontal sinus surgery: The Fulda concept. *Oper Tech Otolaryngol Head Neck Surg* 2 : 234
- Ellis M (1954) The treatment of frontal sinusitis. *J Laryngol Otol* 68 : 478–490
- Goodale, RL (1945) The use of tantalum in radical frontal sinus surgery. *Ann Otol, Rhinol And Laryngol* 54 : 757–762
- Goodale RL, Montgomery WW (1958) Experience with osteoplastic anterior wall approach to the frontal sinus. *Arch Otolaryngol* 68 : 271
- Goode RH (1908) An intranasal method for opening the frontal sinus establishing the largest possible drainage. *Laryngoscope* 18 : 266
- Gross WE, Gross CW, Becker D, et al (1995) Modified transnasal endoscopic Lothrop procedure as an alternative to frontal sinus obliteration. *Otolaryngol Head Neck Surg* 113 : 427–434
- Halle M (1906) Externe oder interne Operation der Nebenhöhleneiterungen. *Berl Klin Wochenschr* 43: 1369–1372, 1404–1407
- Hardy JM, Montgomery WW (1976) Osteoplastic frontal sinusotomy: an analysis of 250 operations. *Ann Otol Rhinol Laryngol* 85 : 523–532
- Howarth WG (1921) Operations on the frontal sinus. *J Laryngol Otol* 36: 417–421
- Ingals EF (1905) New operation and instruments for draining the frontal sinus. *Ann Otol Rhinol Laryngol* 14 : 512
- Jansen A (1894) Zur Eröffnung der Nebenhöhlen der Nase bei chronischer Eiterung. *Arch Laryng Rhinol (Berl)* 1: 135–157
- Kennedy DW, Josephson JS, Zinreich SJ, et al (1989) Endoscopic sinus surgery for mucoceles: a viable alternative. *Laryngoscope* 99 : 885–895
- Killian G (1903) Die Killianische Radicaloperation chronischer Stirnhöhleneiterungen: Weiteres kasuistisches Material and

Zusammenfassung. Arch Laryngol Rhinol 13 :59.

Knapp A (1908) The surgical treatment of orbital complications in disease of the nasal accessory sinuses. JAMA 51 :299

Kountakis SE, Gross CW (2003) Long-term results of the Lothrop operation. Curr Opin Otolaryngol Head Neck Surg 11(1) : 37–40

Lothrop HA (1914) Frontal sinus suppuration. Ann Surg 59 : 937

Luc H (1893) Empyeme latent du sinus frontal duct sans cause apparente: Traitement par l'ouverture de los frontal et la curettage du foyer guérison incomplète. Arch Int Laryngol 6 : 216

Lyman EH (1950) The place of the obliterative operation in frontal sinus surgery. Laryngoscope 60 : 407

Metson R (1992) Endoscopic treatment of frontal sinusitis. Laryngoscope 102 : 712–716

Ogston A (1884) Trephining the frontal sinus for catarrhal diseases. Men Chron Manchester 1 : 235

Ramadan HH (2000) History of frontal sinus surgery. Arch Otolaryngol Head Neck Surg 126 : 98–99

Riedel-Schenke H: Cited by Gosdale RH (1955) The radical obliterative frontal sinus operation: A consideration of technical factors in difficult cases. Ann Otol Rhinol Laryngol 64 : 470

Ritter G (1906) II. Eine neue Methode zur Erhaltung der vorderen Stirnhöhlenwand bei

Radikaloperationen chronischer Stirnhöhleneiterungen. Dtsch Med Wochenschr 32: 1294–1296

Runge: Cited by Stevenson RS, Guthrie D: (1949) A history of otolaryngology. Baltimore, Williams and Wilkins

Schaefer SD, Close LG (1990) Endoscopic management of frontal sinus disease. Laryngoscope 100 : 155–160

Schaeffer JP: Cited by Sier (1911) Rouillons. Arch Int Laryngol 31 : 709

Schoenborn: Cited by Wilkop A (1894) Ein Beitrag zur Kasuistik der Erkrankungen des Sinus frontalis. Wuerzburg, F. Frome.

Sewall EC (1935) The operative treatment of nasal sinus disease. Ann Otol 44 : 307

Stankiewicz JA, Wachter B (2003) The endoscopic modified Lothrop procedure for salvage of chronic frontal sinusitis after osteoplastic flap failure. Otolaryngol Head Neck Surg 129(6) : 678–83

Tato JM, Bergaglio OE (1949) Cirurgia del frontal injerto de grasa. Nueva tecnica (Surgery of frontal sinus. Fat grafts, new technique. Otolaringologica, Oct. 1949) cited according Tato, Sibbald and Bergaglio. Laryngoscope(1954) 64: 504–521

Walsh TE (1943) Experimental surgery of the frontal sinus. The role of the ostium and nasofrontal duct in postoperative healing. Laryngoscope 53 : 75–92

Wells R (1870) Abscess of the frontal sinus. Lancet 1 : 694

Wells WA (1901) On sounding and irrigating the frontal sinus through the natural opening. *Laryngoscope* 10 : 262

Wide K, Sipila J, Suonpaa J (1997) Report on results of frontal sinus obliterations in Turku University Central Hospital, 1977–1994. *Acta Otolaryngol* 529(suppl) : 184–186