8. Historical Overview

Current endoscopic surgery of the nasal sinuses derives its stimulus from two sources: intranasal surgery extending back to the nineteenth century and sinoscopy which was originally used only for diagnosis. A historical review must therefore encompass the early stages of both components. Furthermore it must not only chronicle the past but should also point the way to future developments.

Not every reference can be analyzed, because of lack of time and space, and it has therefore not always been possible to establish the priority of reporting of a technique. Moreover new ideas and practical innovations are often not published at all, or are only reported long after they have been presented at meetings and operative courses and taken up by other surgeons. It seems more important to name the paramount contributions to anatomy, pathophysiology, diagnosis and treatment that have influenced the author's concepts.

Beginnings of Intranasal Sinus Surgery

The first intranasal antral operation is usually ascribed to von Mikulicz, who reported opening of the antral cavity through the middle meatus in 1886. In 1886 Ziem stated that Schaeffer had also used this method often to simplify irrigation for the treatment of a chronic antral infection. Claoué used antrostomy for the same indication, and published a 10-year personal experience in 1912.

Dahmer (1909) created a large inferior meatal antrostomy by resecting the anterior end of the inferior turbinate. He curetted the mucosa from the floor of the antrum itself, and claimed that the resulting ease of irrigation was the actual purpose of his operation. Indeed the patient could carry out the regular irrigations himself.

Other European rhinologists such as Boenninghaus and Hajek who had adopted the method of wide inferior meatal antrostomy, sometimes with resection of the head of the inferior turbinate, had declared themselves satisfied with the rapid decrease of purulent secretion after the operation (cited by Claoué, 1912). In America in 1897, Lothrop carried out a wide inferior meatal antrostomy leading to resolution of suppuration due to various causes, but the antrostomy was regarded merely as a means of irrigation to control the suppuration.

Middle meatus antrostomy described by Siebenmann in 1899 and 1900 had the same purpose, that is the creation of an easily accessible nasoantral opening for long-term irrigation of the antral cavity by the patient himself. He proposed resection of the head of the middle turbinate, and breaking down the fontanelle with the little finger. Zuckerkandl’s (1882) statement that this window generally remained fully patent deserves mention: it was already known at that time that the inferior meatal antrostomy easily closed again (Lothrop, 1897). Kubo in 1912 expressed a preference for a middle meatal antrostomy and Onodi designed a perforator for this purpose in 1902. Gerber (1905), like Onodi, favored middle meatal antrostomy; he created the window in the middle meatus after transoral antral procedures.

Others had different preferences: for example McBride (1900) stated that an antrostomy lying as deeply as possible in the inferior meatus was more correct on surgical
principles (for example Halle, 1906). King (1935) stated that even hyperplastic sinusitis could heal after a simple antrostomy in the inferior meatus, although the radiographic contrast medium was mainly transported to the natural ostium. Thus Lavelle and Harrison in 1971 compared two series and found a higher rate of healing of chronic maxillary sinusitis with fewer complications after a middle meatal antrostomy. A list of advantages of this procedure was presented by Bryant in 1960. Halle in 1906 thought that this route of access was impractical because it lay close to the orbit.

Those who prefer middle meatal antrostomy emphasize that the physiological transport pathways of the antral cavity lead to the maxillary ostium. The credit for the photographic recording of their corkscrew course should be given to Hilding (1931, 1932) who also showed that carbon particles bypassed an inferior meatal antrostomy, and could leave the antral cavity and re-enter it again before finally leaving through the natural ostium. Accurate descriptions were given by Proetz (1941). Messerklinger and Stammberger have provided an impressive film demonstrating this process.

Hilding (1941) recommended making the antrostomy as far as possible from the ostium. Every time that he created an antral window at the maxillary ostium in the healthy antral cavity of the rabbit a persistent inflammation arose which resolved if a new ostium was created at a distance from it. He warned of the caution necessary when transferring the results of animal experiments to the surgical treatment of human disease.

The combination of two antrostomies was described by McKenzie (1921, 1927) and the removal of the entire medial wall by Sluder (1927) who preserved only the inferior turbinate. In 1903 Réthi recommended a large bimeatal perforation and removed the anterior two-thirds of the inferior turbinate.

Straatman and Buiter (1981) recently resurrected the old principle of fontanelotomy which had been in disuse for many decades. They have developed a precise operative technique using the endoscope, and fenestrate the posterior fontanelle under vision using a special instrument.

It is difficult to establish who was the first to surpass simple intranasal antrostomy, and who was the first to carry out transnasal manipulations within the antral cavity without an angled telescope.

In 1900 Dahmer removed chronic hyperplastic mucosa partially or sub-totally based on the concept of radical surgery. He resected the anterior third of the middle turbinate and created a wide opening from the floor of the nose up to the middle meatus, and turned a mucosal flap from the nasal wall into the opening. Réthi (1903) excised all the suspect tissue from the antral cavity using a sharp curette after removing the anterior two-thirds of the inferior turbinate and creating a large bimeatal window. The intracavity manipulations described by Sturmann (1910) are not included under this heading, although his was an intranasal procedure. He used an approach through the piriform aperture, and also resected the anterior wall of the antrum.
It can be assumed that gross lesions of the antral mucosa were removed intranasally by other surgeons through a wide antrostomy created with a punch, as Unterberger emphasized in 1932. However, Schicketanz in 1959 was the first to mention that isolated mucosal cysts could be removed via the inferior meatus. Davison (1969) removed polyps from the antrum using forceps and curettes, but he used the Caldwell-Luc procedure for long-standing disease. All intranasal procedures without endoscopic monitoring should be regarded as modified antrostomy, but they do not merit the criteria for mucosal microsurgery.

Intranasal ethmoid surgery with the unaided eye is also subject to the same limitations, and it is uncertain how complete, precise and safe it has been. This is doubtless the reason that the method, indications, results and operative dangers of intranasal ethmoidectomy remain controversial.

Killian described his technique of resection of the uncinate process with widening of the neighboring ostium in 1900. Halle was probably the first surgeon with extensive personal experience of intranasal ethmoidectomy and frontal and sphenoidal sinusotomy. The important points, such as uniting all individual cells into a common cavity, difficulties with the most anterior cells, indications for chronic empyema, prevention of blind dissection, the topical use of adrenalin and the use of special curved instruments were all described in his work which appeared in 1906. In the English-speaking world, Mosher (1912) initiated intranasal ethmoidectomy for chronic ethmoiditis, centered upon the fine structure of the ethmoid labyrinth. He resected the middle turbinate widely, thus improving the view of the sphenoid and posterior ethmoid sinuses and making the operation safer. Numerous authors adopted the same view including Lederer (1953), Weille (1959), Yankauer (1921), Kidder et al (1974) and Friedman et al (1982). It is interesting that Gruenwald had recommended radical amputation in 1896 and warned against a faint-hearted approach. Others such as Pratt (1925), Davison (1969), Eichel (1972), Guggenheim (1972), Freedman and Kern (1979) and Dixon (1983) emphasized the value of preservation of the middle turbinate to prevent the symptoms of dryness because the nasal cavity would otherwise become too large.

A similar divergence of opinions and results appears in the statements about completeness of ethmoidectomy. Eichel (1972) confirmed that many rhinologists term a limited opening of a few middle ethmoid cells an ethmoidectomy. Many understand the term total ethmoidectomy to include opening of the sphenoid sinus (Dixon, 1983, Wigand, 1981, Eichel, 1972, Friedman et al, 1982) and an antrostomy as well (Davison, 1969, Ashikawa et al, 1982, Wigand, 1981). Others usually leave the sphenoid sinus unopened. Messerklinger (1984) and Stammberger (1985) open the antral cavity if indicated by the individual radiological findings. Many of these aspects can only be discussed if intranasal sinus surgery is raised to the status of precise endoscopic sinus surgery.

Early Stages of Endoscopic Sinus Surgery

The start of endoscopic sinus surgery cannot be ascribed to one date or one person. It began with endoscopic diagnosis which could be combined with the removal of tissue for histology. From this step endoscopic surgical treatment of sinus disease slowly emerged.
Draf in his monograph of 1978 reviewed the literature on endoscopic diagnosis. Hirschmann (1903) was the first to use a reflector, a speculum and the true endoscope for the inspection of the nose and sinuses. His endoscope was made by the firm of Reiniger, Gebbert and Schall in Berlin, based on the cystoscope designed by Nitze in 1897. Other pioneers of this new method refined it for endoscopic diagnosis of the nasal passages, the antrum and the nasopharynx. However, Reichert, Valentin and Sargnon rapidly extended its use to minor procedures such as cautery, opening of cysts, irrigation (Reichert, 1902), measurement of tubal opening (Valentin, 1903) and removal of foreign bodies (Sargnon, 1908, Imhofer, 1910). Until that time the endoscope had only been introduced into the antral cavity through an open dental socket or via the anterior wall (Sargnon), but it is suspected that Spielberg (1922) in the USA was the first to use the intranasal route through the inferior meatus. He used the nasopharyngoscope described by Holmes for inspection of the antral cavity. He named the procedure antroscopy, and used it for work-up before a radical antrostomy or conservative treatment with irrigation. In 1925, Maltz described the sinusoscope made for him by the firm of Wolf in Berlin. He also used an approach through the inferior meatus or through the anterior antral wall. In the succeeding years these and other almost exclusively rigid telescopes with proximal illumination by a very small bulb were used, almost always for diagnosis, including the removal of specimens for biopsy (Portmann, 1925, Watson-Williams, 1930, Slobodnik, 1930, Luededecke, 1932, Christensen, 1946, Hahn, 1955, von Riccabona, 1955 and Bauer and Wodak, 1958). The details were summarized by Draf in 1978.

Endoscopy of the nose and sinuses received a further stimulus by the development of better illuminated endoscopes, such as the telescopes made by Storz with a Hopkins rod, by Wolf with a Lumina telescope with varying angles of vision, and flexible glassfiber bundles for illumination. The intensity of light was increased sixfold, and the size of the field was expanded threefold. The recognition of disease, minor manipulations and photographic documentation were thus considerably facilitated (Timm, 1964, Messerklinger, 1972, Gruenberg, 1971, Hellmich and Herberhold, 1971, draf, 1973, 1978).

Reports of techniques allowing excision of biopsy specimens and more precise removal of tissue such as cysts followed rapidly: small grasping forceps were integrated into the endoscope (Draf, 1973), and a two-channel instrumentation, the bimeatal antral endoscopy was described by Hellmich and Herberhold.

The improved diagnostic capability of nasal and sinus endoscopy was also taken up in other European countries: Illum and Jeppesen (1972) and Draf (1978), compared the reliability of radiography with sinuscopy. Buiter (1976) and Terrier (1973, 1975) demonstrated its value in recording mucosal lesions.

Reynolds and Brandow in 1975 reported intranasal antrostomy for chronic sinusitis: they drilled a small opening into the antral cavity in front of the head of the inferior turbinate under an operating microscope. They introduced a sinuscope through the anteromedial antral window, and were able to inspect the antrum, to carry out irrigation and biopsy, and to insert a Teflon button.

Terrier and Baumann (1976) assessed the validity of endoscopic assessment of mucosal lesions using histomorphology, and established a classification of sinusitis. The value
of this diagnostic procedure is also recognized by maxillofacial surgeons (Schmidseder and Lambrecht, 1977). Draf has extended endoscopy to the frontal and sphenoid sinuses.

Flexible fiberoptic endoscopes have been developed for the investigation of the nose and the nasal sinuses. They include the ENF-P2 rhinolaryngoscope made by Olympus Company with an external diameter of only 3.4 mm, an 85° angle of vision and a 230° arc of the visual field. It can be used for pain-free endoscopy in children and adults, but has not yet replaced the widespread use of the rigid sinus endoscope because of the poorer light output and the necessary bimanual operation. Its place is in diagnostic nasopharyngolaryngoscopy (Yamashita et al, 1984, Lancer and Jones, 1986).

Endoscopic surgery of the nasal sinuses is defined as a range of procedures based on the use of endoscopes with an angled telescope or the microscope. The history of its development is relatively short, and coincides with the renaissance of older intranasal operative techniques that it has influenced continuously in recent times.

The beginning can be dated from 1958 when H. Heermann reported intranasal surgery with the use of a binocular microscope, designed especially for more precise clearance of the middle and posterior ethmoid cells and the sphenoid cavity; it also facilitated the removal of polyps from the olfactory cleft (J. Heerman, 1982). The microscopic view into the antral cavity through the inferior meatus for removal of antral mucosa had previously been mentioned by J. Heermann in 1974. Bagatella and Mazzoni (1980) reported the advantages of the microscope using a lens of 250 or 300 mm focal length for ethmoidectomy for polyposis of the middle and posterior ethmoid cells. Draf (1982) also used the microscope but combined it with an angled telescope. In 1983 Dixon emphasized the increased safety achieved by the microscope for ethmosphenoidectomy, but had to admit that not all regions were visible with this technique.

Trans-septal trans-sphenoidal microsurgery under optical control can be regarded as intranasal sinus surgery, and is the standard procedure for pituitary adenomas.

The rigid endoscope with an angular optical axis offers clear advantages in viewing the sinuses and their recesses compared with the straight field of vision provided by the operating microscope, but it has disadvantages including the tendency to misting and soiling by the warm and bleeding operative field. A much needed technical improvement was the suction-irrigation surgical endoscope with a rotary and interchangeable angled telescope that could remain in situ for a long time (Wigand, 1981). With its help, the intranasal technique of antral surgery could be extended to all forms of chronic maxillary sinusitis (Wigand and Steiner, 1977) and to the intranasal surgery of all nasal sinuses (Wigand, 1981). About the same time other authors began to monitor intranasal procedures in the middle meatus using the rigid-angled telescope: for example Buiter and Straatman (1981) used it for fontanellotomy, and Messerklinger (1980, 1984) and Stammberger (1985, 1986) used it for both partial and total ethmoidectomy. However, both used a straight telescope without suction-irrigation. In the meantime other surgeons have described their experiences (Dixon, 1983, Fenner, 1984, Friedrich, 1985, Kennedy, 1985). Whereas flexible endoscopes
have a certain value in pre- and postoperative diagnosis (Yamashita, Mertens and Rudert, 1984), they have not established themselves for intraoperative use.

The passage of fine instruments alongside the endoscope is preferable to transendoscopic instrumentation. The working channels which need to be integrated in the endoscope are too small, whereas the options for instruments introduced alongside the observation tube are much wider. Thus, the surgical laser has so far only been used by the paraendoscopic method (Wigand, 1981, Buiter, 1984) although specially designed flexible endoscopes may become available if the type of laser, for example Nd:YAG or argon, allows them to be used.

The abundance of new proposals appearing every year illustrates a fascinating chapter of nasal surgery in which technical developments and biological knowledge supplement each other in the perfection of medical treatment.