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FRONTAL SINUSITIS: A STATISTICAL INVESTIGATION.

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THIS paper contains an account of (1) all cases in which the frontal sinus was affected, treated by means of conservative methods and by intranasal operation, in the Ear and Throat Department of the Royal Infirmary, Edinburgh, during the years 1921 to 1930 inclusive, *i.e.*, during the time in which one of us (J. S. F.) has been in charge of the Department; (2) all cases seen in private practice from 1906 to 1930 inclusive; (3) all cases operated upon by one of us (J. S. F.) by the external route at the Royal Infirmary and in private practice (1907-1930).

We have not attempted to distinguish between catarrhal and suppurative affections of the frontal sinus.

The cases have, however, been divided into (*a*) acute and (*b*) chronic; the period of six months has been arbitrarily taken, *i.e.*, all cases of over six months' duration have been regarded as chronic. The cases in which the frontal sinus was affected either alone or in conjunction with other paranasal sinuses, amounted to 338. Of these, 241 were acute and 97 were chronic.

(*A*) Acute Cases.

These numbered 241 (94 right, 116 left and 31 bilateral). *Sex.*—160 were males and 81 females. The *Age* was ascertained in 207 cases, as follows:—11 to 20 years, thirty-five; 21

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to 30 years, seventy-four; 31 to 40, fifty-eight; 41 to 50, twenty-nine; 51 to 60, seven; 61 to 70, four. *Duration.*—In 61 cases the trouble had lasted only one week; in 42, two weeks; in 19, three weeks; in 6, four weeks; in 1, five weeks; in 6, six weeks; in 2, seven weeks; and in 22, three months or over but less than six months. *Cause.*—Coryza or influenza was responsible for at least 142 and injury for 14 cases.

Symptoms.—In 230 cases the patients complained of frontal headache and in at least 183 there was marked periodicity of the pain. The usual time of onset was about 10 or 11 A.M., while the pain usually passed off at 2 or 3 P.M. In rare cases the pain began early in the morning (8 A.M.) and occasionally it did not come on until the afternoon. In a few cases in which pus was under great tension, continuous pain of a throbbing character was present. It is noteworthy that in night nurses and others who are on night duty, the pain came on an hour or two after they got up, so that the period of onset probably depends upon the assumption of the erect posture. Tenderness on pressure over the anterior wall or floor of the frontal sinus was noted in 125 cases, while an orbital complication (swelling of the upper eyelid or abscess formation) was present in 23 patients.

Seasonal Incidence.—January, 18; February, 31; March, 28; April, 30; May, 25; June, 16; July, 20; August, 12; September, 15; October, 19; November, 22; December, 15.

Examination.—Anterior rhinoscopy revealed pus in the anterior part of the middle meatus in 128, pus and polypi in 38, while in 57 cases pus was absent (total 223 cases). The septum was deviated to the affected side in 50 of the unilateral cases and to the non-affected side in 16 cases. Posterior rhinoscopy was carried out in 152 cases and showed that pus was present in 99, pus and polypi in 3, while in 50 cases no pus was found. Bacteriological examination showed that the most common organism was the streptococcus: next in frequency came pneumococci, staphylococci, influenza bacilli, diphtheroids and B. coli. Transillumination.—The frontal sinuses only were obscured in 95 cases, both frontals and antra in 93 (total 188). Radiography.—The frontal sinuses only were cloudy in 42 cases; the frontals, ethmoids and antra in 60: all sinuses obscured in 7 (total 109). It is noteworthy that in eight cases the frontal sinus appeared clear in the radiograms but was found diseased at operation.

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Co-affection of other Sinuses.—The maxillary antra and ethmoid cells were affected along with the frontal sinus in 135 cases, while in ten all the sinuses were affected on the side of the disease. (Note that in some cases, only transillumination was carried out and in others only radiography; in most cases, however, both methods of diagnosis were employed.)

Treatment.—Of the 241 cases (1) 161 were treated by conservative methods only, *i.e.*, menthol inhalations, head light baths and analgesic powders. Irrigation of the frontal sinus has seldom been practised because it was found that in order to enter the frontal sinus with any certainty it was necessary to remove the anterior end of the middle turbinate and open up the anterior ethmoidal cells. If this were done it really amounted to intranasal operation on the frontal sinus, with provision of more or less free drainage. Thereafter the frontal sinus usually recovered without any irrigation. In acute cases in which the frontal sinus, ethmoid and antrum were affected, intranasal operation on the antrum alone, with treatment by inhalations and possibly head light baths often effects a cure without any necessity for operation on the frontal sinus. Of the 161 cases, 105 were males and 56 females.

Results were ascertained in only 83 cases, as follows:—58 were cured by conservative methods; 17 were relieved (pain only coming on during acute coryza); in 6 pain and discharge are still present; in 2 operation was advised but refused. (Note that in previous "follow up" investigations we have found that only about 50 per cent. of patients can be traced.)

(2) **Intranasal Operation: 66 Cases.**—(Preliminary conservative treatment, as detailed above, was tried in 21 of the 66 cases.) As regards intranasal operation, local anæsthesia only was employed in 52 cases; in the remaining 14 both local and general anæsthesia were used. In all cases the anterior end and lower border of the middle turbinate was removed, the anterior ethmoidal and in some cases the posterior ethmoidal cells opened up with Grünwald and Blakesley forceps and the fronto-nasal duct enlarged by upward-cutting forceps and the Watson-Williams rasp. Only in exceptional cases was any attempt made in the subsequent treatment to wash out the sinus with the cannula, dependence being as a rule placed upon the freer drainage obtained by the above method. In 12 cases submucous resection of the septum was performed in addition to the above procedure. In 24 cases, in addition to intranasal

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operation on the ethmoid and frontal sinus, the maxillary sinus was drained, while in five cases the sphenoidal sinus was also opened by the intranasal route.

Complications. — One patient developed erysipelas and another scarlet fever. In several cases there was extravasation of blood at the inner angle of the orbit.

Results.—A cure was obtained in 34 cases; in three the patient reported slight recurrence of frontal pain when suffering from coryza; in eight cases the nasal discharge continues, but the patients have no pain. In 21 cases the result is unknown.

(3) **External Operation** was performed in 14 cases (2 right, 6 left and 6 bilateral). Five of the 13 patients had had previous operations performed, *e.g.*, submucous resection of the septum, opening up of the ethmoidal cells, drainage of the maxillary antrum, intranasal operation on the frontal and sphenoidal sinuses. With regard to the external operation on the frontal sinus: two recent cases were operated upon by removal of the floor of the sinus, together with opening up of the anterior ethmoidal cells and removal of most of the paper plate of the ethmoid, lachrymal bone and also of the frontal process of the superior maxilla and of the middle turbinate (modified Howarth operation). In these cases iodoform gauze was introduced into the frontal sinus, and the end brought down into the nasal cavity, the external wound being closed by silkworm-gut sutures. The packing and stitches were removed in two or three days. One of these patients died (Case VIII.). One case was operated upon by the Killian method. In eleven cases complete obliteration of the frontal sinus was carried out, the anterior wall and floor of the sinus and also the supra-orbital ridge being removed and the mucosa curetted from the posterior wall. In addition, the middle turbinate and ethmoidal cells were more or less completely removed, and in many cases the sphenoidal sinus was also opened through the external incision. At the end of the operation gauze packing was introduced into the cavity between the superficial tissues and the posterior wall of the sinus. One end of the gauze packing was brought out at the external end of the incision, which was otherwise closed with silkworm-gut sutures. The other end of the packing was brought into the nose and was removed in two days. A certain amount of œdema of the upper eyelid occurred in many cases but soon disappeared. It must be admitted that in many of these cases there is a considerable amount of

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deformity, depending on the size and depth of the sinus. On the other hand, in the opinion of the writers, the safety of this operation as opposed to Killian's more than compensates for the degree of deformity.

Conditions Found.—Pus and "granulations" in 12, pus and polypoid mucosa in two.

Complications.—Two patients had slight fever after operation, several had temporary diplopia; one patient developed pneumonia but recovered. One patient had a frontal lobe abscess and recovered (Case III.). Two patients had meningitis on admission and died. One had cavernous sinus thrombosis on admission and died. The remaining patient had septicæmia on admission and died.

Results.—In five a cure was obtained; one reports improvement, but not cure; in four no report was obtained; as stated above, four patients died.

(*B*) Chronic Cases.

Patients in whom the frontal sinusitis had existed for more than six months numbered 97 (30 right, 40 left, and 27 bilateral): 51 patients were male and 46 female. *Age.*—1 to 10 years, one; 11 to 20, nineteen; 21 to 30, nineteen; 31 to 40, six; 41 to 50, six; 51 to 60, eight; 61 to 70, two; 71 to 80, two. *Cause.*—This was more difficult to ascertain than in the acute cases, but in at least 24 the frontal sinus trouble was attributed to coryza or influenza, two cases were due to scarlatina and three to injury. The seasonal incidence does not appear to be of much importance in the chronic cases.

Symptoms.—Frontal headache was complained of in 64 cases but marked periodicity of the headache was noted in only 22.

Examination. — Tenderness over the frontal sinus was present in 36 and an orbital complication in 23. *Anterior rhinoscopy* showed pus in the middle meatus in 36, pus and polypi in a further 41 cases; pus was absent in 16. The septum was deviated to the affected side in 13 cases and to the non-affected side in 7. On *posterior rhinoscopy* pus was noted in the middle meatus in 26 and pus and polypi in 21. In a further 24 cases no pus was noted. *Transillumination.*—In 17 cases the frontal sinus only was obscured, in 58 the frontal sinuses and antra were dark. *Radiography.*—Frontal sinuses only, cloudy in 10; frontal sinuses, antra and ethmoids in 36;

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all sinuses cloudy in 16. It is worthy of note that in four cases the frontal sinuses appeared clear in the radiograms but at operation were found to be diseased.

Co-affection of other Sinuses.—The ethmoids and maxillary antra were affected in 55 cases, while pansinusitis was present in 13 (total, 68 cases out of 97).

Treatment.—(1) In 18 cases the patients would only consent to conservative treatment, though two of these patients had submitted to submucous resection of the septum and seven to drainage of the maxillary sinus.

Results.—Nine of the patients were relieved; eight remained *in statu quo;* of one no report was obtained.

(2) **Intranasal Operation: 39 Cases.**—Local anæsthesia only was employed in 20 cases, while in the remaining 19 both local and general anæsthesia were used. In all of the cases the frontal sinus was drained by the intranasal route according to the method described under (A). Submucous resection of the septum was performed in three cases and drainage of the maxillary antrum in 17, in addition to the frontal sinus operation. In three cases the sphenoidal sinuses were operated on by the intranasal route.

Results.—Cure, 18; no pain but discharge continues, 6; still pain and discharge, 6. One death from septicæmia. No report, 8 cases.

(3) **External Operation** was performed in 40 cases (11 right, 14 left and 15 bilateral). Of the 40 cases, 31 had already been operated upon as follows. Removal of polypi, 6; drainage of antra, 10; operation on antrum, ethmoid and sphenoid, 2; submucous resection of septum in addition to operation on antra and ethmoids, 3; submucous resection of septum with removal of nasal polypi, 2; submucous resection and operation on sphenoid, 1; intranasal operation on frontal and maxillary sinuses, 1; previous external operations on frontal sinus elsewhere, 6 cases. With regard to the operation on the frontal sinus performed by one of us (J. S. F.), we find that the modified Howarth operation was carried out in nine cases, the Killian operation in two cases and the radical operation (complete obliteration) in 29 cases (in two of these 29 cases the Killian operation was performed first of all but had to be converted into the radical operation owing to necrosis of the bridge).

Contents of the Sinus.—Pus and "granulations," 27 cases; pus and polypoid tissue, 10 cases; mucocele, 3 cases (note that

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in these three cases the modified Howarth operation was performed).

Complications.—Severe fever, 1; slight fever, 3; pneumonia with recovery, 1; cavity re-opened on account of persistent œdema, 1; serous meningitis with recovery, 2; septicæmia with recovery, 1; corneal ulcer with complete recovery of vision, 1; meningitis and death in 3 cases.

Results.—A cure was obtained in 21 cases; improvement, but not a cure in 2; no report, 14 cases; death, 3 cases.

Illustrative Cases.

I. *Bilateral Chronic Frontal and Ethmoidal Sinusitis.*—J. R., male, aged 33, seen 2.4.24. Bilateral frontal headache for five years with marked periodicity: previous external operations in Rhodesia. Discharging fistula above right eye; pus and polypi in both middle meatuses; frontal sinuses, ethmoids and sphenoids blurred in radiograms. Complete bilateral operation, 3.4.24; fistula present; pus in sinuses which extended to external angle on both sides; iodoform gauze drainage for two days; œdema of eyelids. Recurrent suppuration, 7.10.26; ethmoidal extension cleared out; cure.

II. *Chronic Pansinusitis.*—S. S., male, aged 38, seen 20.3.25. Bilateral frontal headache for ten days, with periodicity; right middle turbinate polypoid and pus present. Conservative treatment tried. S.M.R., followed by intranasal operation on frontal sinuses in 1927. Complete frontal sinus operation on both sides 6.9.29; pus present (*Pneumococcus* and *B. mucosus capsulatus*); iodoform gauze packing removed in three days; temporary diplopia after operation; patient cured.

III. *Acute Left Frontal Sinusitis; Abscess of Left Frontal Lobe; Operation; Recovery.**—G. L., male, aged 29. Influenza 10.2.22; slight ptosis (left); slight fever; continuous headache and throbbing pain behind left eye. 22.2.22.—Jacksonian fit affecting right side of face, arm and leg, lasting one and a half hours, preceded and followed by loss of speech for a short time.

2.3.22.—First examination by J. S. F. showed no swelling of mucosa or pus in the nose; tenderness present over left frontal sinus; transillumination showed all sinuses dark and radiograms demonstrated blurring of all sinuses. 3.3.22.—Frequent vomiting; pulse 38; early optic neuritis; slow speech; absence of abdominal reflex and presence of Babinski's sign on contralateral (right) side; brain abscess diagnosed by Professor Bramwell. *Operation.*—General anæsthesia; pus under

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pressure in left frontal sinus; posterior wall removed; granulations on outer surface of dura; large quantity of odourless pus evacuated from left frontal lobe (pneumococcus); recovery.

A year or two later the patient developed status epilepticus. The left frontal lobe was again investigated but no recurrence of abscess was found; large trephine opening made over Rolandic area on left side by Professor Wilkie and Mr. Norman Dott but nothing abnormal found. The patient recovered. 29.3.31.—Patient very well.

IV. *Osteoma in Left Frontal Sinus.*—M. S., female, aged 37, seen 26.5.30 complaining of pain over the left side of the nose. On anterior and posterior rhinoscopy both sides of the nose appeared normal. Radiograms showed a dense shadow in the left frontal sinus.

14.6.30.—General anæsthesia; radical frontal sinus operation. Killian incision with vertical cut on forehead; thin anterior wall of sinus removed and osteoma exposed; the outline of the bony growth followed the contours of the sinus and resembled the Prince of Wales feathers. The growth was rooted in the lower part of the sinus. The floor of the sinus was also removed. There was a little mucus or thin mucopus between the osteoma and the narrow remaining cavity in the upper part of the sinus. A large opening was made into the nose, most of the middle turbinate being removed and the anterior ethmoidal cells freely opened. The cavity was packed with iodoform gauze and the external wound sutured except at the outer end, which was drained; satisfactory progress. 12.11.30.—Deformity slight; nasal cavities look well.

V. *Acute Bilateral Frontal Sinusitis with Pachymeningitis Externa and Interna; Death.*—A. M., female, aged 21, seen 16.8.09. Coryza six weeks ago; frontal headache two weeks, with swelling above left eye; shivering attack five days ago, with stoppage of nasal discharge. On admission: drowsy; marked tenderness in left frontal region; temperature 103° F.; pulse 104; respiration 32. Pus in left middle meatus. Immediate operation: pus in both frontal sinuses. Lumbar puncture gave fluid under great pressure. 17.8.09.—Temperature 105° F. 18.8.09.—Patient very drowsy; internal strabismus left eye. Second operation—posterior wall of left sinus removed; foul greenish pus evacuated (numerous organisms); dura opened; brain explored, but no abscess; hernia cerebri formed. 19.8.09.—Death. *Post-mortem.*—Extensive meningitis between dura and arachnoid, over cortex and, to a lesser extent, in the middle fossa.

VI. *Acute Pansinusitis (left); Cavernous Sinus Thrombosis; Operation; Death.*—J. O. B., male, aged 45, suffered from nasal catarrh and sore throat 16.12.19. Discharge stopped and a painful swelling appeared at upper and inner angle of left orbit 18.12.19. Temperature 101° F. Patient first seen and admitted 20.12.19 with

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proptosis and restricted movements of left eyeball and chemosis of conjunctiva (cavernous sinus thrombosis). Nasal septum almost blocked left nostril; tongue dry.

Immediate operation.—Local anæsthesia; intranasal operation on left ethmoid; no pus.

Evening temperature 102° F.; patient delirious. 21.12.19.—Second operation: general anæsthesia; Killian incision; left frontal, ethmoidal and sphenoidal sinuses opened; mucosa congested; no pus; wound left open. For the next three days evening temperature rose to 103° F.; pulse and respirations accelerated. 26.12.19.—Patient much better; swelling of eyelids decreased and movements of left eyeball improved. Dr. J. V. Paterson reported congestion of veins of fundus, but no optic neuritis. 27.12.19.—Congestion of base of right lung; respirations rapid.

29.12.19.—Delirium alternating with coma; third operation; general anæsthesia; posterior wall of left frontal sinus removed; no extradural abscess; no subdural abscess or abscess of frontal lobe. 1.1.20.—Kernig's sign present; deep coma; temperature 103° F.; death.

Post-mortem.—Purulent meningitis over both frontal lobes; slight meningitis at base; gelatinous mucopus in left maxillary antrum (staphylococcus, pneumococcus and diptheroid bacillus isolated).

Microscopic examination by Dr. Logan Turner and Dr. Reynolds (*Journal of Laryngology and Otology*, 1927, vol. xlii, p. 181) showed infiltration of mucosa of sphenoidal sinuses by pus cells, with hæmorrhages; almost complete obliteration of the blood spaces of the left cavernous sinus by fibrous tissue; some pus and blood-clot were also present in the cavernous sinus. Dr. Turner and Dr. Reynolds regarded the sphenoidal sinuses as the focus of infection.

VII. *Acute Suppuration in Frontal, Ethmoidal and Sphenoidal Sinuses; Purulent Lepto-meningitis; Death.*—A. S., male, aged 19, admitted 22.3.29. Influenza three weeks before admission; constant supra-orbital headache for one week, with swelling of lower part of forehead. On admission occipital headache present; patient drowsy; temperature 103° F.; pulse 112; tongue furred and breath foul; fluctuating swelling over glabella; eyelids on both sides œdematous. Pus on anterior and posterior rhinoscopy. *Immediate operation.*—General anæsthetic; double Killian incision; erosion of anterior wall of right frontal sinus; foul pus present in both sinuses (non-hæmolytic streptococcus); inter-sinus septum perforated; anterior wall of both sinuses removed; mucosa necrotic; posterior wall of sinuses very pale. Ethmoidal cells cleared out and sphenoidal sinuses freely opened; all contained pus.

24.3.29.—Patient very restless; temperature raised; coma, followed by death.

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Post-mortem—Purulent meningitis present over right hemisphere from vertex to base (pneumococcus and Pfeiffer's bacillus); no abscess present.

Remark.—There can be no doubt that in this case and also in Case V. purulent meningitis was present on admission.

VIII. *Acute Frontal, Ethmoidal and Sphenoidal Suppuration (left); Septicæmia: Meningitis; Death.*—S. B., male, aged 28, first seen 25.4.30. Recent left frontal headache and nasal discharge. Examination showed œdema of conjunctiva and proptosis, with limitation of movements of left eye and reduced vision. Pus present in both nasal cavities; tenderness over left frontal sinus; left frontal and maxillary sinuses dark on illumination. Radiograms showed little difference between right and left side (radiograms often unreliable); temperature 102° F. 26.4.30.—Left middle turbinate removed and ethmoid opened up; left sphenoid opened; modified Howarth operation left frontal sinus; pus obtained (*Staphylococcus aureus*). 28.4.30.—Less bulging of eyeball; still œdema of conjunctiva but eye movements better; no optic neuritis; temperature 102° F.; abscess in gluteal and deltoid regions opened (*S. aureus*). 29.4.30.—Blood-culture shows *S. aureus*. 2.5.30.—Evening fever continues; general condition unsatisfactory; hypertonic saline given intravenously. 14.5.30.—Evening fever continues; tenderness over both frontal sinuses and left antrum. Second blood-culture shows hæmolytic streptococcus. 19.5.30.—Deltoid and gluteal abscess healed; edges of Killian incision have come apart. 22.5.30.—Edges of wound pared and stitched. 28.5.30.—Blood-culture negative. Signs of old tuberculous lesions at both apices, with definite cavities. 4.6.30.—Patient mentally peculiar, refuses to speak. 6.6.30.—Kernig positive; cerebrospinal fluid turbid and under pressure (*Pneumococcus mucosus* present on culture); slight dysphagia present; death. *Post-mortem.*—Extradural abscess in left frontal region; inner table eroded; cario-necrosis of posterior wall of frontal sinus and of roof of sphenoid; small sequestra present; mucus only present in left frontal sinus and ethmoidal and sphenoidal sinuses; mucopus present in right frontal sinus; no thrombosis of venous sinuses but early leptomeningitis present over both hemispheres (*S. aureus* and *P. mucosus* obtained on culture).

IX. *Chronic Pansinusitis; Septicæmia: Empyema; Death.*—D. M., male, aged 36, seen 24.2.20. Frontal headache with nasal obstruction and discharge for several years; previous removal of nasal polypi. Deviation of septum; pus in left middle meatus and roof of nasopharynx. Radiograms showed all sinuses cloudy. 26.4.20.—Local anæsthesia; S. M. R.; intranasal operation on right frontal sinus and both ethmoids and sphenoids. 28.4.20.—Evening temperature 99.6° F.; pain in joints and limbs. 30.4.20.—Profuse perspiration; temperature

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104° F. 2.5.20.—Dullness at right base; pus withdrawn. 3.5.20.—Rib resection and drainage of empyema (pure culture of streptococci); patient delirious. 4.5.20.—Death. *Post-mortem.*—Old tuberculous foci in left lung, with adhesions; right lung collapsed; brain membranes congested; brain œdematous; no evidence of bone disease, meningitis or venous thrombosis.

X. *Chronic Suppuration in Left Frontal Sinus; Radical Operation; Purulent Lepto-meningitis: Death.*—D. McI., male, aged 23. History of shrapnel wound involving left eye and cheek in 1916: submucous resection and Caldwell-Luc operation on left maxillary antrum, with removal of piece of shrapnel in 1919. Patient admitted 8.2.21: pus in left middle meatus; sinus discharging pus below left eyebrow; radiogram showed left frontal and ethmoidal cells obscured.

21.2.21.—External operation on left frontal sinus: cavity contained thickened mucosa and pus. While curetting a cell on the posterior wall of the cavity, a slight escape of cerebrospinal fluid occurred. Careful disinfection and free drainage of the cavity carried out.

24.2.21.—Patient restless and vomiting: temperature 102° F.: severe headache present. Lumbar puncture evacuated turbid cerebrospinal fluid (pneumococcus present). Wound opened up and posterior bony wall of sinus removed; dura mater covered with granulations and adherent to bone; dura opened but no pus evacuated; hypertonic saline gauze packing. 25.2.21.—Death.

Post-mortem.—Recent purulent meningitis over left frontal lobe; an area of old meningitis present in region of left olfactory bulb; no brain abscess.

XI. *Chronic Suppuration in Right Frontal Sinus and both Maxillary Sinuses; Meningitis; Death.*—W. S., male, aged 42, admitted 21.6.22. History of small abscess above right inner canthus opened by his doctor eighteen months before admission. Anterior and posterior rhinoscopy showed no pus: transillumination and radiograms showed dullness of frontal, ethmoidal and maxillary sinuses. Proof puncture evacuated foul pus from both antra.

6.7.22.—Radical operation right frontal sinus: fistula in floor of sinus; mucosa congested and thickened; pus in cavity; most of lachrymal bone and lateral mass of ethmoid removed; iodoform gauze packing; partial drainage of external wound. 13.7.22.—Wound healed. 19.7.22.—Carious teeth extracted.

1.8.22.—General anæsthesia; radical operation on both maxillary antra; mucosa swollen and foul pus present. 8.8.22.—Slight evening fever. 15.8.22.—Remains of right middle turbinal removed. 18.8.22.—Evening temperature 103·2° F.; occipital headache; slight neck stiffness; Kernig positive. Lumbar puncture: fluid turbid and under pressure (long-chained diplo-streptococci). 21.8.22.—Fever continues

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but there is less retraction of head; patient sleeps well. 22.8.22.—Temperature 100·2° F.; pulse 68; no vomiting; no optic neuritis. Neurologist suspects frontal lobe abscess. *Third operation.*—Killian incision re-opened: frontal sinus quite obliterated; posterior wall removed with gouge; dura normal; dura opened and frontal lobe explored with negative result; left frontal sinus investigated but found healthy.

24.8.22.—Death. *Post-mortem* examination showed small hole in roof of nose on right side at the point where the cribriform plate joins the small wing of the sphenoid: sphenoidal sinus healthy. Meningitis, however, was more marked on left side though there was no apparent lesion in the roof of the nose on this side.

XII. *Chronic Suppuration from Sinus above Inner Canthus (left side); Radical Operation; Meningitis; Death.*—Mrs J. R., aged 80, seen 1.2.24 suffering from purulent nasal discharge of many years' duration and from discharge of foul pus from a sinus above the inner canthus on the left side. Anterior and posterior rhinoscopy showed polypi and pus in the middle meatus. On transillumination both frontal sinuses and left antrum dark. Radiograms showed extensive left frontal sinusitis.

5.2.24.—General anæsthesia: radical operation left frontal sinus; Killian incision; large hole in floor of left frontal sinus, surrounded by very soft bone; foul pus in sinus; posterior wall eroded in several places; left middle turbinal removed and ethmoidal cells cleared out; iodoform gauze packing with intranasal drainage.

Progress fairly satisfactory till 9.2.24, when there was sudden loss of consciousness at 10.30 P.M. Temperature 100·6° F.

11.2.24.—Death. *Post-mortem.* Purulent meningitis; ventricles slightly dilated; red softening in anterior part of left frontal lobe; lungs showed pleurisy and hypostatic congestion; mitral and aortic valves diseased and aorta atheromatous.

Mortality.—There were 105 intranasal operations with one death and 54 external operations with seven deaths. In four of these cases the frontal complication was already present on admission—purulent meningitis in two, cavernous sinus thrombosis in one, and septicæmia in one.

Dr. J. P. STEWART said: "Dr. Fraser and I wish to apologise for the dullness of our paper. Our excuse is that it involved at least six months' hard work; and secondly, that it does give an accurate account of the subject as far as lies in our power.

"With regard to the cause of the periodicity of pain in frontal sinusitis: our own view is that it is due to the assumption of the erect posture and, in support of this, we may mention a

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case in which the pain came on at the usual time—10 A.M.—but passed off when the patient lay down.

"There is a considerable difference between the symptoms met with in acute and chronic cases. For instance, frontal headache was present in at least 95 per cent. of the acute as compared with only 66 per cent. of the chronic cases; periodicity of the pain was noted in 76 per cent. of the acute and in only 23 per cent. of the chronic, while tenderness on pressure was found in 52 per cent. of the acute and in only 37 per cent. of the chronic cases.

"As regards co-affection of the other sinuses, we may note that this was more frequent in the chronic (70 per cent.) than in the acute cases (60 per cent.).

"It is of interest that nearly fifty of our cases were referred to the Ear and Throat Department from the Ophthalmological Department to which the patients had first of all been sent by their own doctors. It is evident that many general practitioners are as yet ignorant of the symptoms and signs of frontal sinus suppuration. They appear to think that supraorbital headache, with pain and tenderness over the eyebrow region, is due to some visual disturbance.

"It has been found that neither transillumination nor radiography is absolutely to be relied on in the diagnosis of frontal sinusitis. In some cases the affected sinus illuminated well, but was cloudy in the radiogram. In others the affected sinus did not illuminate, but appeared clear in the radiogram; we refer of course to cases in which operation showed pus to be present. We recommend, therefore, that these two methods of investigation should be carried out consecutively and the results compared. It would then be possible to form a fairly accurate idea of the condition of the suspected sinuses.

"In acute cases of middle-ear suppuration it is very common to have an acute maxillary sinusitis on the same side, but rare to have the frontal sinus also affected.

"It is noteworthy that patients are far more willing to allow radical operations on the maxillary antrum than on the frontal sinus; no doubt this is because the latter involves a scar on the face. In this connection we admit that in many of our radical frontal sinus operations there is considerable disfigurement. Many of these cases were operated on after it had been found that Killian's operation was unsatisfactory, and even dangerous, but before the publication of Mr. Howarth's paper. We intend

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in future to make more frequent use of Mr. Howarth's procedure, especially in acute cases.

"We believe that incision in the (unshaven) eyebrow line leaves a less noticeable scar than when the incision is made beneath the eyebrow. This is especially marked in our recent acute cases, in which the Howarth operation was performed.

"The rapidity of healing after the Killian incision is remarkable; this no doubt is due to the excellent blood supply to the part.

"Though the removal of part of the frontal process of the superior maxilla and of the paper plate of the ethmoid involves the exposure of the tear sac and the groove in which it lies, it is noteworthy that tear sac troubles very seldom follow external operation on the frontal sinus and ethmoid. In our series there is only one case in which epiphora followed operation."

Diese Schrift enthält einen Bericht aller Fälle, die sich um den angegriffenden Frontal Sinus handeln, welcher mittels conservativer Methoden, intranasalen Operationen und durch Operation bei dem äusseren Methode, am Royal Infirmary in Edinburgh, während einer Periode von 10 Jahren behandelt wurde; gleich falls durch Operation bei dem äusseren Methode, während einer Dauer von 20 Jahren, auch am Royal Infirmary in Edinburgh.

Statistiken aller Fälle die in privat Praxis während 25 Jahren beobachtet worden sind werden auch einbegriffen die Fälle sind in zwei Gruppen eingeteilt worden, nämlich (*a*) Akute und (*b*) Chronische Fälle. Aus der total Summe von 336 Fällen in welchen der Frontal Sinus entweder allein oder in Verbindung mit anderen paranasalen Sinusen angegriffen worden war, waren 241 akute und 97 chronische Fälle.

Ein ausführlicher Bericht der Symptome, ihrer Untersuchung und Behandlung mit derer Resultate wird in jeder Gruppe der Fälle gegeben. Komplicationen werden auch besprochen und eine sehr interessante Liste erläuternder Fälle, welche von ungewöhnlichen character sind beigefugt. Die Wichtigkeit der verschiedener Behandlungs Methoden werden angedeutet und die gewöhnlich gebrauchten Methoden beschrieben.

Cet article décrit tous les cas de sinusites frontales que l'on traités a l'Infirmerie Royale d'Edimbourg depuis dix ans par les méthodes conservatrices et par les opérations des voies externes et

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intranasales. Aussi les statistiques sur les opérations par la voie externe remontent à 20 ans, et celles survenues dans la clientèle privée à 25 ans.

Les cas sont divisés en (*a*) cas aigus et (*b*) cas chroniques. Le nombre total de ceux qui furent atteints de sinusite frontale ou de sinusite frontale compliquée par d'autres sinusites paranasales s'élève a 338 dont 241 sont aigus et 97 chroniques. Une déscription détaillée est donnée des symptômes, de l'examen, du traitement et des resultats de chaque groupe de ces cas. On explique aussi les complications, et on ajoute une liste des cas qui réprésentent des caractères speciaux et rares. On indique la valeur des méthodes du traitement et on décrit celles dont on se sert habituellement.

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