TRANS-SPHENOIDAL HYPOPHYSECTOMY

(A TRANS-SEPTAL EXTRANASAL APPROACH)

By KELVIN E. THOMAS (London)

THE hypophysis cerebri which lies surrounded by vital structures in the centre of the head has aroused interest for generations. Its inaccessibility has challenged many surgeons. The first attempts to decompress and hence to relieve the symptoms caused by an expanding tumour in the sella turcica were performed transcranially by Krause (1905) and Horsley (1906). Because of the high mortality and technical difficulty of this operation, others directed their attention to the trans-sphenoidal approach. Among these surgeons were Schloffer (1907), Hirsch (1910), Chiari (1912), and Cushing (1912). As neurosurgery developed, Cushing abandoned his sublabial trans-septal route, and pioneered the transcranial approach. Interest was solely in tumours of the hypophysis, and hypophysectomy remained essentially in the domain of neurosurgeons.

In the early 1950's, a number of events brought about a change which resulted in a renewed interest in the hypophysis. Hormone-dependence of certain forms of breast cancer led Huggins and Dao (1953) to perform bilateral adrenalectomy and oöphorectomy for the elimination of œstrogen formation, and Luft and Olivecrona (1953) to the surgical ablation of the hypophysis in these cases. Cortisone, essential in maintenance therapy, became available on a commercial scale, and with the advances in antibiotic therapy, knowledge in the control of ensuing metabolic and biochemical imbalances, and the application of microsurgery, new methods of ablative therapy were sought.

Among these methods were ablation by implantation of radioactive yttrium or gold grains, by proton beam radiation, ultrasonic irradiation, and cryohypophysectomy. There was at the same time a renewed interest in the extirpation of the hypophysis *via* the trans-sphenoidal approach.

There are a variety of routes to the sphenoidal air sinus. Hirsch approached it trans-septally through an incision in the nasal vestibule. This gives a very narrow access, but used in combination with the trans-ethmoidal approach of Chiari (1912), Bateman (1963) and Angell James (1964) have all had notable success. The trans-ethmoidal approach (Escher and Roth, 1957; Riskaer, Fog and Hommelgaard, 1961), the trans-antroethmoidal approach (Hamberger, Hammer, Norlen and Sjogren, 1961), and the osteoplastic trans-septal approach (Macbeth, 1961), have all been satisfactory routes. The technique of dissection of the hypophysis

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and of the control of cerebrospinal fluid flow has been the same whichever method is used.

The removal of the hypophysis may be indicated in tumours of the hypophysis such as the eosinophile, basophile, or chromophobe adenoma, and in Cushing's syndrome. Other indications are diabetic retinopathy, malignant exophthalmos, cardiac œdema which is not responding to diuretics, chorionepithelioma and malignant melanoma, but there is yet some doubt as to its efficacy in these conditions. That it may abolish pain or bring about a regression of tumour growth in a proportion of those suffering from carcinoma of the breast or prostate is certain, and research is being carried out at several centres in an attempt to predict the response of patients with breast cancer to subsequent endocrine ablation. Notable among these researches is that on urinary steroid estimation (Bulbrook, Greenwood, and Hayward, 1960). This work has been carried out on the patients of Professor Atkins at Guy's.

Metastatic breast cancer is the dominant indication for hypophysectomy. In this group of patients, the operation is considered when all other methods have failed. Many are severely ill with extensive metastases, but being a last resort procedure, few are deemed too ill for hypophysectomy. Among those who are, however, are those who present as a severe anæsthetic risk, and those who have marked jaundice as evidence of liver failure. Mention should also be made to two other possible contraindications. The first is the patient whose mental deterioration is such that she will be unable to care for herself on discharge from hospital, and the second is the bed-ridden due to severe spinal cord lesions. These two contraindications are humanitarian in nature, but are included here to assist in the sometimes difficult decisions that have to be made.

The contraindications to the trans-sphenoidal approach are gross nasal sepsis, and superior vena caval obstruction which makes the control of cerebrospinal fluid escape impossible, due to raised pressure. Poor pneumatization of the sphenoidal sinus is not necessarily a contraindication to this approach.

Pre-Operative Preparation

The patient is admitted to hospital a few days before operation. In addition to a general physical examination, each patient has a full blood picture, determination of blood group, and 2 pints of blood are made available in case of need. Serum electrolyte estimation is of value in correcting post-operative electrolyte imbalance should it occur. Lateral and submentovertical radiographs are taken to show pneumatization of the sphenoids, the position of the intersphenoidal septum, the anatomy of the sella turcica, and to exclude sinus disease. Anterior and posterior

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rhinoscopy is performed to exclude gross nasal sepsis, and a full face and profile photograph is taken to serve as a record for comparison before and after operation.

We have followed the cortisone régime as used at St. Thomas' Hospital. Cortisone therapy is commenced the day before operation with 100 mg. of cortisone acetate given intramuscularly, and a second injection is given on the day of operation; 100 mg. of hydrocortisone hemisuccinate sodium is given 4 hours before surgery is due to begin. Premedication of omnopon and scopolamine is given and anæsthesia is administered *via* an oral cuffed endotracheal tube. Vasoconstriction of the nasal mucosa is attained by the instillation into the nasal cavities of a solution containing cocaine, adrenaline, and sodium bicarbonate (Moffett, 1941). This solution is aspirated after an interval of 10 minutes, and the operating table is tilted slightly in the head up position. An intravenous infusion of dextrose saline is set up.

The trans-septal extranasal approach to the hypophysis (Thomas, 1964) has been carried out on nine patients. The access to the sella turcica that this approach affords has been found to be adequate provided that a 300 mm. objective lens is attached to the Zeiss operating microscope in place of the 200 mm. lens which is commonly used in aural surgery. This gives a suitable working distance for the manipulation of instruments. In addition, the straight Portmann drill handpiece is necessary on account of its slender construction. The instruments which are used are those for submucous resection of the nasal septum, a pair of Joseph's saws, and a thin $\frac{1}{2}$ in. osteotome for nasal outfracture (Fig. 1). The special instruments for hypophysectomy are shown in Fig. 2.

The Operation

The dorsum of the nose and the line of osteotomy on each side of the base of the lateral wall is infiltrated with 8 to 10 c.c. of 1 : 250,000 adrenaline in normal saline. A midline incision is then made from the glabella to the tip of the nose, reaching firmly to bone in the upper half, but just to perichondrium in the lower half of the incision. The lines of cleavage between the upper nasal cartilages and septum are identified and separated by dissection (Fig. 3). The mucosa of the septum is then freed on both sides, including that portion in the angle made by the nasal bone with the perpendicular plate of the ethmoid bone. The internasal suture is then separated with a thin osteotome by firm pressure, care being taken not to damage the underlying mucous membrane.

The border of the pyriform aperture is located by palpation with the handle end of a scalpel and a stab incision is made through the soft tissues and periosteum lateral to the border of the pyriform aperture (Fig. 4). A periosteal elevator is then placed subperiosteally through this

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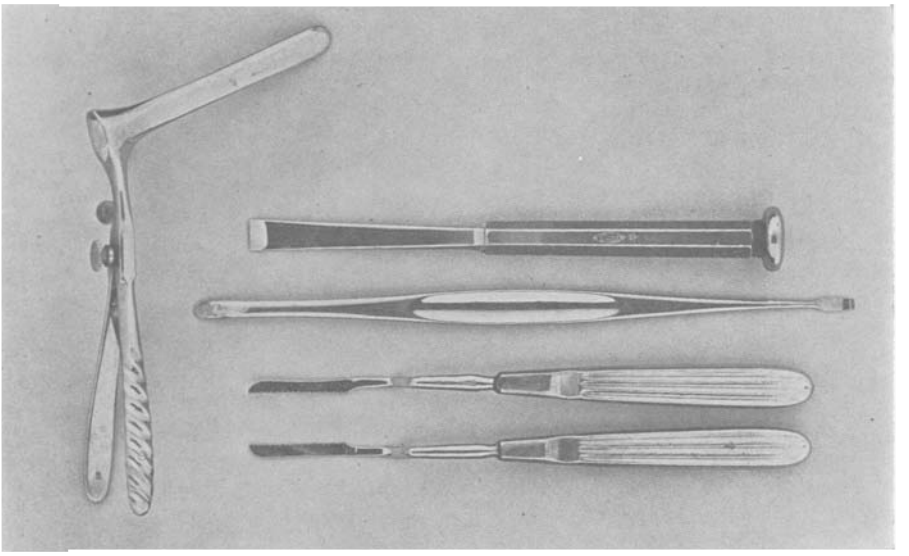


FIG. 1.

Left: 3½ in. Killian's speculum. Centre top: ½ in. osteotome, Howarth's rugine, right and left Joseph's saws.

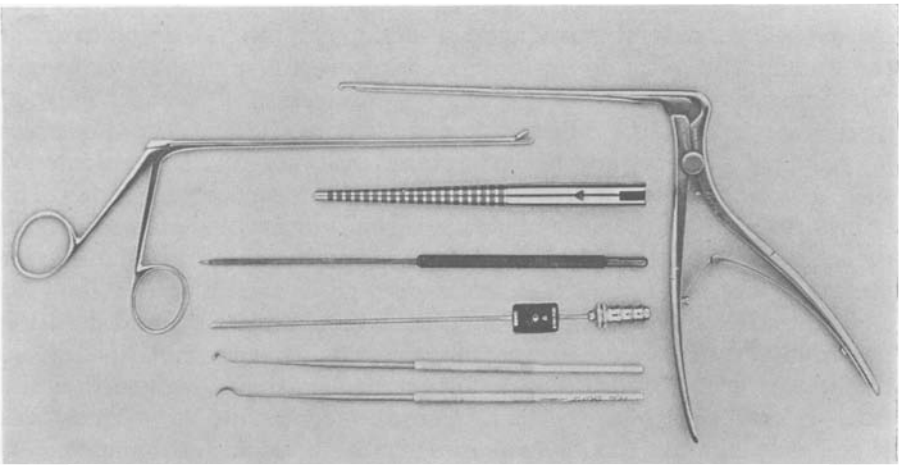


FIG. 2.

From top: Angell James punch forceps, pituitary forceps, Portmann drill hand-piece, diathermy point, fine suction end, and Angell James dissectors (set of six).

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FIG. 3.
Midline incision showing the nasal septum.

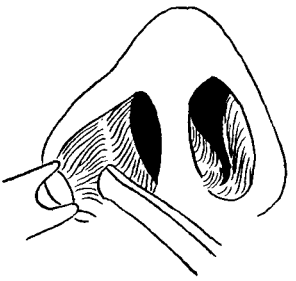


FIG. 4.
The border of the pyriform aperture is located.

incision, and pushed upward along the base of the lateral wall of the nose to a point just anterior to the medial palpebral ligament, thus creating a subperiosteal tunnel for the introduction of a Joseph saw. The patient's head is immobilized by an assistant, and the saw directed parallel to the base of the lateral wall so as to cut through it (Fig. 5). The sawing is performed by light pressure, and continued within the same bony groove until a slight "give" indicates the penetration through the bone. A few remaining strokes completes the separation. The line of osteotomy is cleared of bone dust by introducing a suction end into the deepest part of the tunnel. This bone dust is potentially osteogenic and may result in a thickening along the side of the nose.

The same procedure is undertaken on the opposite side. The two halves of the lateral wall may now be outfractured by leverage with the osteotome.

The upper half of the septum is removed by submucous resection. The cribriform plate of the ethmoid bone is in a vulnerable position, and its perpendicular plate should be removed in small fragments. The inferior portion of the nasal septum is retained to give support to the nasal tip and columella (Fig. 6). The $3\frac{1}{2}$ in. Killian speculum is advanced until the reflection of mucosa from septum to sphenoidal conchae is reached. Here the mucous membrane is more adherent, but, with gentle dissection, the entire nasal surface of the sphenoidal conchae comes into view. The blades of the speculum are forcibly separated so as to displace the middle turbinates laterally, and is retained in this position by tightening its holding screw (Fig. 7).

The Zeiss operating microscope is now set up. The upper two-thirds of the buttress of bone formed by the articulation of the vomer with the

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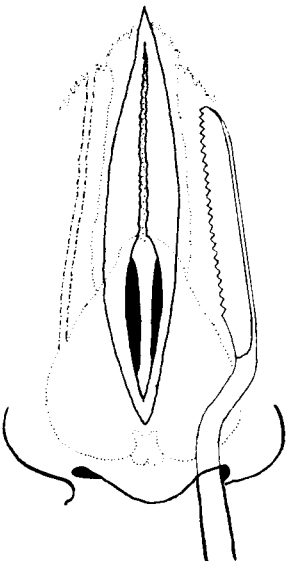


FIG. 5.

The internasal suture has been separated and an osteotomy made at the base of the lateral wall of the nose.

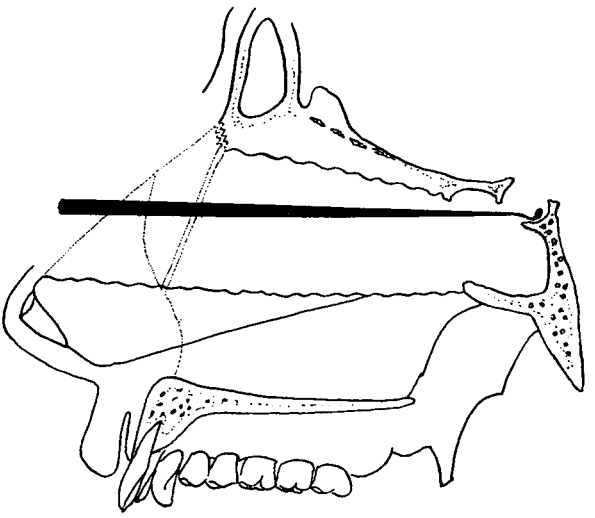


FIG. 6.

The inferior portion of the nasal septum is retained to give support to the nasal tip and columella. The border of the pyriform aperture and the osteotomy is shown in broken line.

sphenoidal conchae is removed with a large burr, and this surface is thinned until penetration occurs on each side of the midline. This reveals the underlying mucous membrane of the sphenoidal sinuses. This membrane is extremely delicate and every care must be taken at this stage not to cause a breach in its surface. The mucosa is separated from the undersurface of the sphenoidal conchae, and this plate of bone is removed with punch forceps.

The intersphenoidal septum is defined, and its mucosa is dissected from both surfaces and from the posterior wall of the sinus cavity. The speculum is now released and advanced so that it lies in the full depth of the sphenoidal sinus. The intersphenoidal septum is removed with Henkel's forceps, and the speculum once again retained by its holding screw. In the event of an absent septum, or a septum which is displaced markedly to one side, the dissection is carried out along the lateral wall until the bulge of the sella turcica is fully visualized (Fig. 8). The resultant wound cavity is funnel-shaped and is approximately $2 \times 3{\cdot}5$ cm. at the skin surface and extends to a depth of 7 to 8 cm.

At this stage the operation for the removal of the hypophysis follows a standard technique. Using a small burr the anterior bony wall is removed by excavating an oval area until a blue-grey line appears. A breach is then

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FIG. 7.
The nasal surface of the sphenoidal conchae as seen under magnification.

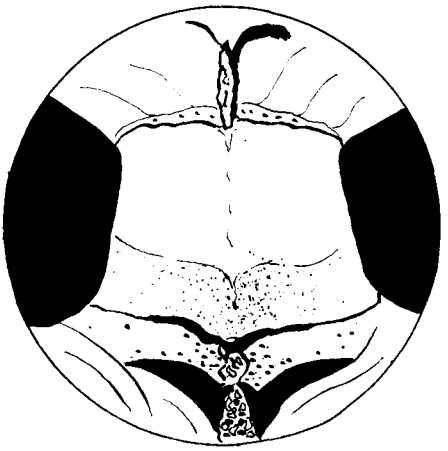


FIG. 8.
The blades of the speculum lie within the sphenoidal sinus and display the bulge of the sella turcica.

made, and with Angell James punch forceps, this bone is removed to expose dura. The defect is enlarged if necessary. The dura, consisting of inner and outer layers, is incised horizontally by diathermy equidistant between the anterior communicating sinus superiorly and the intercommunicating sinus inferiorly if present. The gland is seen to bulge slightly between the edges of the incision, and dissectors are employed to free it from its dural capsule. The gland is removed with forceps. The fossa is then packed with a small piece of gauze soaked in Zenker's solution and the sphenoidal cavity is packed with ribbon gauze while a muscle graft is taken from the thigh. This fixative is used in an attempt to destroy any remaining fragment of glandular tissue which might otherwise regenerate and so bring about an ineffectual remission (Luft and Olivecrona, 1953).

Two pieces of muscle are used. The first is of a size just to fill the sella turcica, and the second is made to lie against it in the posterior part of the sphenoidal cavity. This in turn is held firmly in position by a length of $\frac{1}{2}$ in. ribbon gauze soaked in neomycin and hydrocortisone cream. The end of this pack is brought out through a stab incision made in the columella of the nose.

The two halves of the lateral wall of the nose are now replaced, and the midline incision is closed by subcutaneous catgut sutures and interrupted skin sutures. The nasal cavities are packed lightly, and a plaster of paris splint is applied to the nose.

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Post-Operative Management

This régime again follows that used at St. Thomas' Hospital. Penicillin and sulphadiazine are given, and continued until the tenth post-operative day. The patient is put on a quarter-hourly pulse and 1-hourly blood pressure chart, and any severe rise in pulse rate or fall in blood pressure is controlled by 100 mg. hydrocortisone hemisuccinate sodium given *via* the intravenous infusion. This is repeated every 6 hours if necessary. Intramuscular aldosterone 0·5 mg. may be indicated in certain cases of acute shock, if adrenocortical insufficiency is suspected and a response to intravenous hydrocortisone is not obtained.

The nasal packs are removed on the second post-operative day, and the nasal vestibules are cleared of crusts. The sphenoidal pack, the end of which emerges as a short wick through the columella of the nose, is shortened by a few millimetres each day in order to keep the track open. It is removed on the ninth day in the ward and causes no discomfort to the patient.

The patient is given 25 mg. of cortisone t.d.s. as soon as she can take by mouth, and this is reduced to 25 mg. b.d. at the end of the first week. This dose may later be reduced to 12·5 mg. b.d. The presence of an intercurrent infection, hæmorrhage, general anæsthetic or surgical operation, calls for an immediate increase in dosage which must be continued until the period of stress is over.

The patient is put on a fluid chart, and diabetes insipidus is controlled by the intramuscular injection of pitressin tannate in oil (1 ml. containing five units) every 2 or 3 days. Serum electrolyte estimations are made and any electrolyte imbalance is corrected. After 2–3 weeks, when the nasal cavities have returned to normal, posterior pituitary snuff in a dose of 2/3 g. (40 mg.) from once to three times in 24 hours may be substituted for the injected preparation.

The skin sutures are removed on the fourth post-operative day, and the plaster of paris splint is renewed. This splint is discarded on the seventh post-operative day.

The patient is encouraged to get up on the second or third day, and in favourable cases may be discharged in 2–3 weeks.

Most patients develop some degree of myxœdema after a few months, and this is shown by an abnormal gain in weight associated with lassitude. The level of serum cholesterol, which is elevated in hypothyroid states, is a valuable guide to the correct dosage of thyroid extract. It should not be allowed to exceed 350 mg./100 ml. Usually 1 g. daily will maintain a state of good health, but as much as 3 g. may be required.

Discussion

The purpose of this paper has been to describe in detail a method of trans-sphenoidal hypophysectomy which has been found satisfactory in

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nine patients. The trans-septal extranasal approach has provided a midline and short route to the sella turcica, and the technique of submucous resection has not only shown itself to be comparatively free of blood, but has allowed an uncontaminated access to the hypophysis. Moreover, by virtue of the midline approach, vital blood vessels and important nerves are avoided which are vulnerable in an oblique approach. The only structure at risk is the cribriform plate, but its position is readily recognized. It serves as a valuable guide to the sella.

Once adherence of the mucosal layers has taken place, nasal anatomy and physiology are largely unaltered. There has been no noticeable abnormality on anterior or posterior rhinoscopy, and the sense of smell has returned in the second or third week.

This has been a very small series and we have not encountered any of the serious complications of this operation such as hæmorrhage, meningitis or wound sepsis. One case of cerebrospinal rhinorrhœa occurred. This was fortunately slight, and it stopped spontaneously on the sixteenth post-operative day. Had it become necessary to repack the sella, it would have been undertaken through the original route.

The employment of two separate pieces of muscle graft is believed to serve as a double precaution against cerebrospinal fluid leak. The first graft is positioned to seal the defect in the diaphragma sellae, and the second to seal the dural incision made by diathermy. In addition it is felt that there is less likelihood of dislodgement of the first graft if perchance the second is slightly adherent to the ribbon gauze when this is removed.

This approach should cause no deformity of the nose and the midline scar soon becomes barely noticeable (Figs. 9a and b). As part of the cartilaginous septum which forms the dorsal border of the nose is necessarily removed, a slight flattening of this part of the nose may be unavoidable. Careful attention to the subcutaneous sutures of the incision should largely correct this undesirable result, and in the case of a prominent nasal hump (Fig. 10), the trimming of the dorsal border of the nasal bones would have given a more pleasing profile.

Of the nine patients all but the first were suffering from metastatic breast cancer; the first was a man with cancer of the prostate. In the earliest cases, removal of the hypophysis was unfortunately incomplete. This was mainly due to lack of experience, but also due to the lack of proper instruments. The greater working distance afforded by the 300 mm. objective lens, the Portmann drill hand-piece, and a slender pituitary forceps of my own design, have enabled all the later cases to have a total extirpation of the hypophysis. Indeed in two cases the gland was removed complete in one piece.

It is hoped that this approach may appeal to surgeons in this speciality as it is but an extension of an operation which is performed routinely,

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(*a*)



(*b*)

FIG. 9.
(*a*) 17.9.64, (*b*) 16.10.64. Appearance before and after operation.

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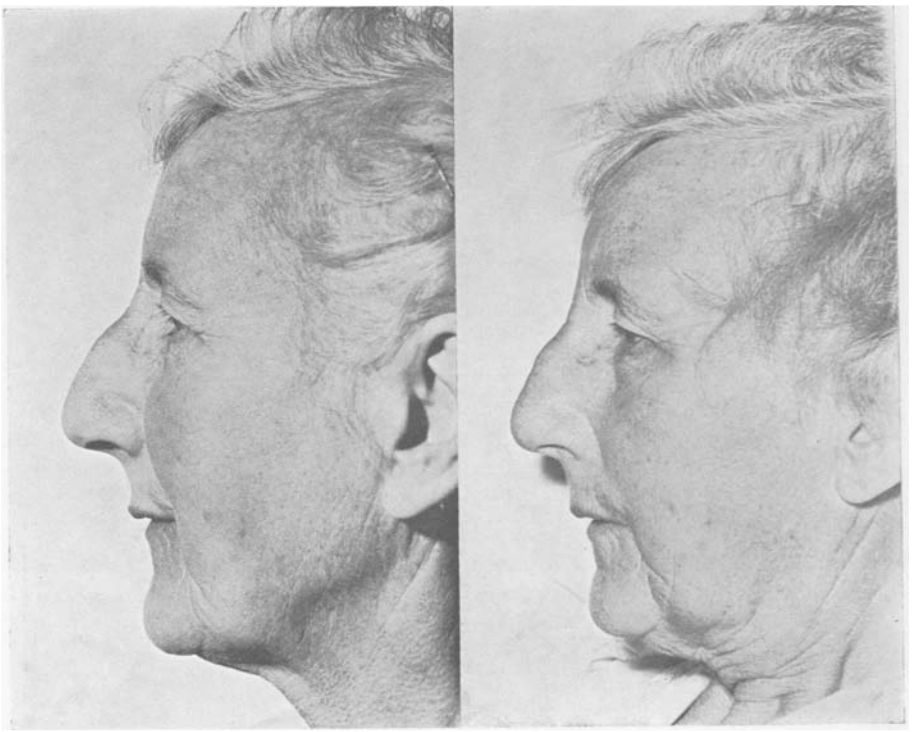


FIG. 10.
The dorsal border of the nasal bone should have been trimmed so as to give a better profile.

namely the SMR. Moreover, to those who delight in microsurgery, it affords the same finesse that one encounters in the ear.

Acknowledgments

I would like to pay tribute to the memory of Mr. L. M. Rouillard, Plastic Surgeon, whom I assisted in many a rhinoplasty, for it was through this association that the idea of outfracture of the lateral wall of the nose was conceived. I must convey my grateful thanks to Professor H. J. B. Atkins, Mr. P. V. Reading, and Mr. C. H. Kinder, for allowing me to operate on their cases, and to Mr. G. H. Bateman, Mr. J. Angell James, and Mr. P. H. Schurr, for kindly permitting me to see their techniques.

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Ear and Throat Department,
Guy's Hospital,
London, S.E.1.

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