Squamous Carcinoma of the Paranasal Sinuses in the Bantu*

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SUMMARY

Thirty-three cases of squamous carcinoma of the paranasal sinuses in South African Bantu are presented. The incidence, pathology, clinical features and treatment of this disease are discussed. Radical telecobalt therapy, followed by extended maxillectomy after an interval of 4 weeks, is recommended as the most effective form of therapy in selected cases.

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Carcinoma of the paranasal sinuses is a distressing disease, in terms of both the patient's suffering and the poor results of treatment. This article is based on a review of 33 new cases which were treated jointly by the Department of Otorhinolaryngology, Baragwanath Hospital, and the Department of Radiation Therapy, Johannesburg Hospital, from 1967 to 1969. Only 1 patient was lost, giving a 97% follow-up.

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INCIDENCE

South African Bantu have the highest incidence of paranasal sinus carcinoma in the world.[1] Squamous carcinoma accounts for about 80% of the malignant tumours of this region. The incidence of this neoplasm is declining, however, while the incidence of lower respiratory tract carcinoma is rising in this population. The changing pattern is reflected in Table I.

TABLE I. PERCENTAGE FIGURES SHOWING THE CHANGE IN THE RELATIVE FREQUENCY OF RESPIRATORY TRACT CARCINOMAS IN AFRICANS AND EUROPEANS FROM 1950 - 1968*

	Whites			Bantu		
	1950	1950-1963	1968	1950	1950-1963	1968
Paranasal sinuses	5	5	1	73	37	13
Nasopharynx	10	7	3	8	13	7
Larynx	18	22	14	11	22	28
Lungs	67	66	82	8	28	52
Total	100	100	100	100	100	100

* Records of the Department of Radiation Therapy, Johannesburg Hospital.

From Table I it will be seen that in 1950, 73% of respiratory tract tumours in the Bantu occurred in the paranasal sinuses. In 1968 the figure was only 13%. In Whites the percentage of respiratory tract carcinomas arising in the paranasal sinuses was 5% in 1950, and 1% in 1968. On the other hand, carcinoma of the bronchus is now the commonest respiratory tract tumour in both population groups. In the Bantu the incidence rose from 8% in 1950, to 52% in 1968; in the Whites from 67% in 1950, to 82% in 1968.

This tendency may be explained by a change in tobacco habits. The high incidence of carcinoma of the antrum in the Bantu has been correlated with the use of snuff.[2] Snuff samples prepared by the Bavenda and Zulu tribes were found to contain as high a concentration of 3,4-benzpyrene as does cigarette smoke condensate.[3] The habit of smoking cigarettes is increasing in the Bantu population, while the use of snuff appears to be declining.

Of the 33 cases reviewed 24 were males and 9 were females. During the years 1949 - 1951 the sex ratio of this disease in the Bantu was males: females—22:5. The slight increase in the female numbers may be explained by the assumption that more women are attending hospitals. In carcinoma of the larynx and lungs, however, over 80% of the cases occur in males in both racial groups (Table II).

The ages of the 33 patients reviewed ranged from 24 - 76 years, with a mean of 52 years. This is about a decade younger than the mean age incidence in Whites.

In 22 of the cases the right paranasal sinuses were affected, the left side being involved in 11 cases. This difference has not been observed in other series, and may be due to the manner in which snuff is taken.

CLINICAL FEATURES

Early diagnosis is difficult as symptoms occur late in the disease. The following symptoms and signs may occur:

Pain in the region of the cheek.
Areas of paraesthesia or anaesthesia of the cheek.
Swelling of the cheek or palate.
Nasal obstruction or tumour visible in the nose.
Dental symptoms, viz. toothache, loose teeth, failure of a tooth socket to heal after extraction.
Unilateral offensive or bloodstained nasal discharge.
Recurrent epistaxis.
Displacement of the eye, with proptosis or epiphora.
Ulceration of the skin of the cheek.

The maxillary sinus is most frequently affected, but by the time of diagnosis other sinuses are usually involved, particularly the ethmoid sinus.

Staging of the tumour is carried out according to the TMN system proposed by Sisson, Johnstone and Amir.[4]

Tumour

T1: Invasion of (*i*) anterior wall or (*ii*) naso-antral wall or (*iii*) anteromedial palate.

T2: Invasion of (*i*) lateral wall but not muscle, and (*ii*) superior wall but not orbit.

T3: Invasion of (*i*) pterygoid muscle, (*ii*) orbit, (*iii*) anterior ethmoid cells but not cribriform plate, and (*iv*) anterior wall with skin involvement.

TABLE II. RESPIRATORY TRACT CARCINOMA ACCORDING TO SITE, RACE AND SEX*

	Whites						Bantu					
	1949 - 1951			1968			1949 - 1951			1968		
	Males	Females	%	Males	Females	%	Males	Females	%	Males	Females	%
Paranasal sinuses	4	3	5	0	1	1	22	5	73	5	3	13
Nasopharynx	10	4	10	2	0	3	2	1	8	4	0	7
Larynx	23	2	18	10	0	14	4	0	11	14	3	28
Lungs	80	14	67	48	12	82	3	0	8	29	3	52

* Records of the Department of Radiation Therapy, Johannesburg Hospital.

T4: Invasion of (*i*) cribriform plate, (*ii*) pterygopalatine fossa, (*iii*) nasal fossa, (*iv*) contralateral antrum, (*v*) pterygoid plates, (*vi*) posterior ethmoid cells and (*vii*) sphenopalatine recess or sphenoid sinus.

Nodes

N0: No clinically palpable nodes.
N1: Clinically palpable nodes that are not fixed.
N2: Clinically palpable nodes that are fixed.

Metastases

M0: No metastases.
M1: Systemic metastases.

This classification is more specific than that used by Ohngren,[3] who divided the tumours by a plane from the inner canthus of the eye to the angle of the jaw into antero-inferior and posterosuperior groups, and further, by a line perpendicularly through the pupil, each group was divided into medial and lateral. Antero-inferior tumours are more easily resected than posterosuperior tumours, and carry a better prognosis.

The staging of the tumour is accomplished on the basis of clinical and radiological findings. The clinical assessment must include examination of the postnasal space, the cranial nerves, the teeth, the nasal cavity, the palate, the eye and the neck.

A simplification of the TMN system for the purpose of deciding treatment is as follows:

Stage 1: T1 N0 M0.
Stage 2: T2 N0 M0; T3 N0 M0.
Stage 3: T1 N1 M0; T2 N1 M0; T3 N1 M0; T4 N0 M0.
Stage 4: T4 N1 M0; any tumour with M1 or N2.

Radiology

A full nasal sinus examination is required in these cases and this should include:

1. P A (Caldwell) view—orbitomeatal line perpendicular to the cassette.
2. Occipitomeatal (Water's) view—orbitomeatal line at 45 degrees to the central beam. A 30-degree occipitomental view is helpful additional projection.
3. Basal view—patient prone with the orbitomeatal line as closely parallel to the film as possible. The tube requires slight caudal tilting with the beam entering through the angle of the mandible.
4. Lateral view—the orbitomeatal line or the sagittal plane ensures accuracy.
5. Tomography in both the anteroposterior and lateral planes is an accurate ancillary investigation, but is generally of less value than the standard sinus views.

The X-ray features of carcinoma of the antrum are as follows:

1. Opacification of the antrum.
2. Soft-tissue invasion of the nasal cavity.
3. Disruption of the cheek.
4. Erosion of bone. This must be systematically assessed:
   (*i*) Invasion of the maxillary roof (orbit) is seen in the Water's view, P A (Caldwell) view, and the lateral view.
   (*ii*) Invasion of the lateral wall is defined by the Water's view and the basal view.
   (*iii*) Invasion of medial wall and ethmoid sinus is seen in the basal view, Water's view and P A view.
   (*iv*) Invasion of the posterior wall and pterygopalatine fossa or sphenoid sinus is seen in the basal view and lateral view.
   (*v*) Invasion of the floor is seen in the P A (Caldwell) view and lateral view.

Biopsy

The diagnosis is confirmed by histological examination of biopsy material. Where the tumour is visible in the nasal cavity or oral cavity, a punch biopsy can be performed under local anaesthetic. A representative specimen must be secured, as the superficial tissue may demonstrate only chronic inflammation or polypoid change. Negative biopsies should be repeated if malignant disease is suspected on clinical grounds. When a Caldwell-Luc exploration is required to see the tumour, only a small segment of tissue should be excised to prevent lymphatic dissemination by the trauma. All tissue removed from the nose during 'nasal polypectomies' should be submitted for histological examination.

Pathology

Squamous carcinoma accounts for about 80% of the malignant tumours of the paranasal sinuses in the Bantu. Table III indicates the distribution of malignant tumours of the paranasal sinuses seen at the Department of Otorhinolaryngology, Baragwanath Hospital, from 1967 to 1969.

TABLE III. CLINICAL EXPERIENCE WITH MALIGNANT TUMOURS OF THE NASAL SINUSES 1967 - 1969

	No. of cases
Squamous carcinoma (including anaplastic)	33
Malignant mixed salivary tumour	2
Ameloblastoma	2
Adenoid cystic carcinoma	3
Adenocarcinoma	1
Lymphosarcoma	1
Osteogenic sarcoma	1
Chondrosarcoma	1
Aesthesioneuroblastoma	1

The degree of differentiation of squamous carcinomas varies in different parts of the same tumour, and histological grading is of little value unless the neoplasm is anaplastic or the specimen is examined as a whole. Biopsy specimens may not always reflect the true histological appearance of the whole tumour. In this series of

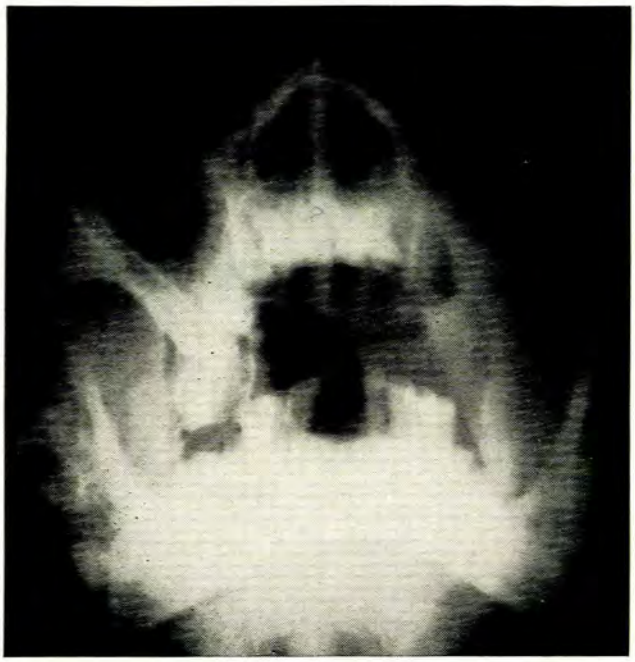

Fig. 1. Water's view of skull in a patient with carcinoma of the ethmoid and maxillary sinus.

Fig. 2. Basal view of skull in the same patient shown in Fig. 1, demonstrating erosion of the base of the skull.

33 cases the grading was as follows: 15 were anaplastic; 10 were moderately well differentiated; 4 were well differentiated; and in 4 cases the histological grading was either lost or not stated.

All the tumours in this series were advanced, i.e. T3 or T4. The antrum appeared to be the primary site of tumour in all the cases but one, where the ethmoid sinus was involved primarily.

Metastases

The normal lymphatic drainage of the maxillary sinus is posteriorly to the retropharyngeal nodes, and thence to the upper deep cervical and submandibular nodes. Since the first stage of lymph nodes cannot be palpated, the real incidence of lymph node metastases in this disease is unknown. Cervical lymph node metastasis is rare, and occurs late in the disease, usually only after there is invasion of skin, the buccal sulcus or the pterygoid muscles. Systemic metastases are also late and unusual manifestations.

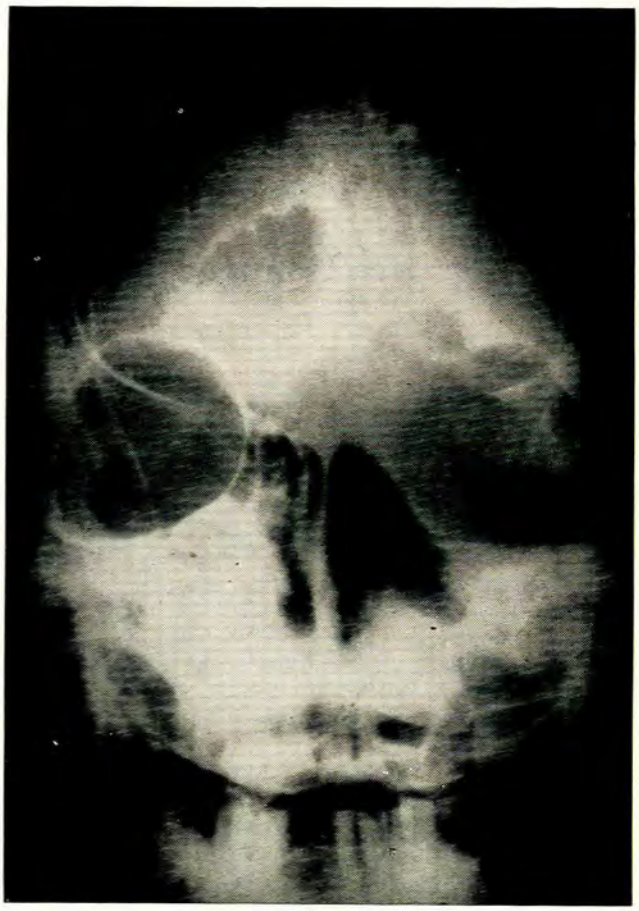

Fig. 3. P A view of the skull in the same patient shown in Figs. 1 and 2, demonstrating invasion of frontal sinus and anterior cranial fossa.

Fig. 4. P A view of skull in a case of maxillary sinus carcinoma.

TREATMENT

The over-all results of treatment are poor, irrespective of the methods employed. Some recent reports are summarized in Table IV.

TABLE IV. TREATMENT RESULTS AFTER 5 YEARS

	No. of cases	No. alive	% alive
Baker et al. **(1966)**[6]			
Radiation	3	1	33
Surgery	5	3	60
Pre-operative radiation plus surgery	11	5	45
Surgery plus postoperative radiation	6	2	33
Total	25	11	44
Kawata (1966)[7]			
Transoral incision maxillectomy	32	9	28·1
Facial incision maxillectomy	103	18	17·3
Total	135	27	20
Sisson et al. **(1963)**[4]			
Stage 1	2	2	100
Stage 2	4	3	75
Stage 3	9	4	44
Stage 4	44	4	9
Total	59	13	22

A policy of radical pre-operative radiotherapy followed by radical surgery is becoming accepted as the most effective means of improving cure rates. Radiotherapy should precede surgery, since impairment of the blood supply and reduction in oxygen tension reduce radiosensitivity. It is no longer accepted that pre-operative radiotherapy seals off the lymphatics by fibrosis, so that tumour cells are prevented from disseminating. There is good evidence, however, that following surgery, previously irradiated tumour cells left behind show less mitotic activity. This is called a mitotic link death. Moreover, peripheral tumour cells are probably more sensitive than those in the centre of the tumour, which is relatively more anoxic. The prime purpose of pre-operative radiotherapy is to reduce the bulk of the tumour and to destroy the viability of malignant cells, particularly those which may be peripheral to the line of subsequent excision.

The 33 cases in this series were treated in 3 groups.

Group 1: Palliative radiotherapy. These patients, for various reasons, did not complete a course of radical cobalt teletherapy. Some refused treatment after therapy was commenced. Others were moribund on admission, and died before therapy was completed.

Group 2: Radical radiotherapy. These patients received a radical course of cobalt teletherapy, viz. 6 000 rads in 6 weeks.

Group 3: Combined therapy. In this group, a radical course of cobalt teletherapy (6 000 rads in 6 weeks) was followed after an interval of 4 weeks by maxillectomy. All 6 of the patients in this group were classified as T4, and the histology was not considered in the selection of cases for this treatment. Cases were excluded from group 3, however, if surgery was refused, or if systemic metastases were present, or if the general condition precluded surgery, or if there was huge ulceration of the face, invasion of the contralateral antrum or the cribriform plate. Invasion of the pterygopalatine fossa, the infratemporal fossa or the posterior ethmoidal cells was not considered a contra-indication to surgery. With these criteria for selection a better prognosis in group 3 may be expected.

The results of treatment are shown in Table V.

TABLE V. RESULTS OF TREATMENT OF 33 PATIENTS

		Years of survival				
Treatment	Cases	Less than 1	1	2	3	% 2-year survivals
Palliative radiotherapy ...	12	8	3	1	—	8
Radical radiotherapy* ...	15	6	5†	2†	1†	20
Combined therapy	6	3	—	2†	1†	50

* In this series 1 patient was lost to follow-up.
† These patients are still alive.

The 3 cases in group 3 who died showed no local recurrence of tumour. One died of a pulmonary embolus in the postoperative period. One died of systemic metastases

after 6 months. The third patient had a simultaneous excision biopsy of a small mobile submandibular lymph node which contained carcinoma; this patient also died of systemic metastases after 6 months. The 3 who survived are well and without recurrence of tumour. One of these had a poorly differentiated carcinoma.

Surgical Technique

A variety of procedures are in current use in the treatment of maxillary carcinoma.

Palatal fenestration. This procedure was originally designed for local removal of tumour and subsequent implantation of radium. The technique is still practised for the purpose of inspecting the maxillary sinus cavity after radiotherapy. The operation is inadequate for this purpose and fails to relieve pain or offensive odour by 'drainage' of the antrum.

Partial maxillectomy. This term refers to the resection of the alveolus, the palate or the anterior wall of the maxilla, or all of these structures. These procedures may be done per-orally without skin incisions, and they are satisfactory for the removal of smaller tumours at these specific sites, viz. stage 1 tumours.

Radical or extended maxillectomy. Since most patients present with T4 tumours, the resection may have to circumscribe disease involving the orbit, malar bone, pterygopalatine fossa or ethmoids. Pre-operative radiotherapy decreases the bleeding and in no way compromises healing of the skin flap. The skin incision extends from the medial canthus of the eye, along the side of the nose, under the nostril to the columella, and vertically through the philtrum of the upper lip. The transverse limb of the Weber-Ferguson incision, extending below the lower eyelid, is unnecessary. If orbital exenteration is required the incision is extended upward below the curve of the eyebrow.

The skin flap is reflected and the orbital periosteum is detached from the orbital floor as far posteriorly as the inferior orbital fissure. The maxilla is then resected in a single bloc. A Gigli saw is threaded through the inferior orbital fissure and the malar bone is divided lateral to the zygomatic recess of the antrum. Medially the frontal process of the maxilla is divided and the incision is carried posteriorly along the fronto-ethmoidal suture to encompass the ethmoid sinus. The hard palate is divided just lateral to the midline with a chisel, preserving the nasal septum, if the tumour permits. The soft palate is detached from the hard palate with a knife. A finger is then placed in the postnasal space to palpate the pterygoid plates which are then divided close to the base of the skull, carrying the maxillary tuberosity with them. Any remaining cells or mucosa in the ethmoidal roof and spheno-ethmoidal recess are removed with a punch forceps. The raw inner surface of the skin flap and masseter is lined with a skin graft.

The orbit itself is rarely invaded by paranasal sinus carcinoma, and can usually be preserved. The eyeball rests on a firm suspensory ligament (thickening of Tenon's capsule) and does not drop in the postoperative period. In some cases, however, orbital exenteration is required, and permission for this should be obtained before the procedure. The eyelids and conjunctivae are usually preserved. When the orbital periosteum is exposed by erosion through the orbital floor, the decision regarding orbital exenteration poses a difficult exercise in judgement.

An acrylic resin obturator should be fitted as soon as possible, to minimize contracture of the skin flap, and to permit eating and speaking. A temporary stent prosthesis is adequate for the first 2 weeks. A good obturator maintains the facial contour and the cosmetic disfigurement is surprisingly little.

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