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Nervous system involvement in malignant tumours of the nose and paranasal sinuses[1]

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Summary

One hundred and eighty-three cases with malignant tumours of the nose and paranasal sinuses have been studied retrospectively. Sixty-eight showed evidence of involvement of the central nervous system based on clinical findings, X-rays and findings on operation or autopsy. Among these, in thirty-six there was direct extension of the tumour through the base of the skull, commonly into the anterior cranial fossa. In seven there were metastatic deposits in the cranial bones. Twenty-seven presented with clinical features suggestive of involvement of the central nervous system.

Résumé

183 cas de tumeurs malignes du nez et des sinus de la face ont été étudiés rétrospectivement, 68 ont montré des complications du SNC, décelées cliniquement, par les Rayons X, en cours d'opération ou par autopsie. Parmi ceux-ci, 36 tumeurs avaient franchi la base du crâne, généralement dans la fosse crânienne antérieure. 7 cas présentaient des dépôts métastatiques dans les os crâniens. 27 présentaient des caractères cliniques suggérant des complications du SNC.

Malignant tumours of the nose and paranasal sinuses are usually not seen early, and in West Africa it is common to see them in the advanced stage, by which time, in a large percentage of them, local spread is so extensive that it has often spread beyond the limits of the upper jaw and developed metastases. Because of the gravity of the visible lesions, studies of tumours in this area have often glossed over the frequency with which the central nervous system is involved. Because of its proximity, the central nervous system is often involved by infiltration along the cranial nerves through the numerous foramina in the base of skull or directly by erosion through bone. The less common mode of involvement is by direct metastases to the brain or by extension from metastases in the calvarium secondarily invading the brain. The incidence of metastases by either of these routes is still small compared with that of metastases to other regions.

This paper is a retrospective study and analysis of 183 patients with cancer of the nose and paranasal sinuses seen in the 10 years between 1960 and 1969 in the Ear, Nose and Throat Department of the University College Hospital, Ibadan, Nigeria. The diagnosis was histologically confirmed in all but twenty-four cases, who for various reasons either refused admission or did not keep their appointment for biopsy. The diagnosis in these cases was based on clinical and radiological findings only. Though most of the patients seen in this hospital come from the Western State in which the hospital is situated, as might be expected, patients are referred from any part of the country. During most of the period under consideration, the Ear, Nose and Throat Department in Ibadan was one of only two such units in the whole country. Though one might expect to have a reasonable cross-section of the types of tumours of the nose and paranasal sinuses in our study, no attempt is being made to calculate the incidence of such tumours in the general population, for various reasons which one will not discuss here. It might be significant to point out that malignant tumours of

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the nose and paranasal sinuses form about 1·9% of all the cancers recorded in the Ibadan Cancer Registry (Edington & Maclean, 1965) and this reflects the incidence of cancer at least in the Western State. Patients with Burkitt's lymphoma are not included in these figures, since they are normally considered separately.

The assessment of the extent of the central nervous system involvement in this study is based on clinical signs and symptoms suggestive of involvement of the nervous system, the findings in plain radiography and tomography as well as the findings at operation. Patients with secondaries in the spine are not included. Necropsy examination was performed on only three patients.

Of the 183 patients, 115 showed no evidence of involvement of the nervous system; the primary being localized to the upper jaw and orbit, with or without glands or secondaries elsewhere in the body. Twenty-seven had symptoms suggestive of nervous system involvement and forty-one showed evidence of intracranial spread.

Involvement of the nervous system

In forty-one patients in this series, there was evidence of intracranial spread of the tumour on admission. Twenty-eight were males and thirteen were females (Table 1). In twenty-five the spread was into the anterior cranial fossa and this was commonly demonstrated by radiography as areas of complete bony destruction of the roof of the orbit, cribriform plate or frontal bone. In seventeen cases, this extension was into the middle cranial fossa. Here the common radiographic finding was destruction of the wings or body of the sphenoid bone or pituitary fossa as well as gross enlargement of the foramina and fissures communicating with the middle fossa. In six cases there was evidence of encroachment into both the middle and anterior fossae, and in one of these at necropsy the tumour was found to have infiltrated into the posterior cranial fossa as well. In view of the advanced stage at which most patients turned up for treatment, it was not always possible even to contemplate complete excision. Ten of these patients had radical excision of the tumours, eleven had palliative excision of the main mass only. During the surgical procedures, the duramater was found to be infiltrated in seven, in two of which the tumour had infiltrated into the frontal lobes of the cerebrum. A diagnosis of involvement of the pituitary fossa and gland was made in four cases only, two of these confirmed at necropsy, though there was radiological evidence of destruction of the sphenoid sinus and basisphenoid in fourteen cases.

Metastases into the bones of the skull were discovered in seven cases. In four cases the parietal bone was involved, in one the temporal bone and in the other two there were multiple secondaries in various bones, in addition to direct extension of the primary tumour from its site of origin into the cranial fossa. These metastases were not confirmed histologically. The histology of the primary was sarcoma in seven, plasmocytoma in three and carcinoma in thirty-one; being a squamous cell carcinoma in nineteen, adenocarcinoma in nine and transitional cell carcinoma in three.

Involvement of the eye and cranial nerves

Extension of the tumour into the orbit occurred very

TABLE 1. Tumours of the nose and paranasal sinuses

Site of tumour	No. of cases
Extension into the cranial cavity	41 (Male, 28; Female, 13)
Invasion of the anterior cranial fossa	19
Invasion of the middle cranial fossa	11 } 36
Invasion of the anterior and middle cranial fossa	6
Secondaries in the parietal bones	4
Secondaries in the temporal bones	1
Multiple secondaries in the skull bones	2
Infiltration of duramater seen	7
Infiltration of the frontal lobes seen	2
Infiltration of the pituitary gland	4
Deposits on the eyeball or optic nerves	3
Total	183 (Male, 116; Female, 67)

TABLE 2. Signs of involvement of the central nervous system

Sign	No. of cases
Ophthalmoplegia (without involvement of the orbit)	19
Sixth cranial nerve paralysis	6
Optic atrophy	6
Facial paralysis	1
Paralysis	3
Convulsions and epileptic fits	3
Meningitis	3
Mental changes, confusion	5
Severe persistent headaches	13

commonly; thus seventy patients presented with proptosis, in six of whom the lesion was bilateral. There were, in addition, three others whose presenting feature had apparently been unilateral proptosis and these had therefore had the affected eye removed before being referred to this unit. Although in a few cases with proptosis impairment of vision was minimal; in the majority there was some demonstrable impairment. In seventeen cases the affected eye was blind, and in sixteen there was ophthalmoplegia with a fixed and dilated pupil and of course impairment of vision. Twenty-five others who had no radiological evidence of destruction of the orbital walls, nor a clinically palpable tumour mass in the orbit, nevertheless showed evidence of intracranial spread of the tumour in the form of complete ophthalmoplegia in nineteen cases and lateral rectus paralysis alone in six (Table 2). In six cases optic atrophy was detectable, becoming bilateral in one of these within a few days of admission. In one patient tumour seedlings were seen on the globe of the eye at operation and in two on the optic nerve.

Facial pain, hypoaesthesia and trismus were signs suggestive of fifth cranial nerve infiltration. Pain was sometimes severe and constant and its distribution depended on the branch of the trigeminal nerve involved. Of the twenty-four patients who complained of these symptoms seventeen previously had multiple tooth extractions, because of a combination of the unhealthy state of their teeth and the distribution of pain, without any relief. Radiography in these cases showed destruction of the pterygoid plate, the greater or lesser wings of the sphenoid and gross widening of the foramen ovale. This last suggested intracranial extension from the ptergo-maxillary fissure along the nerves to the region of the Gasserion ganglion, as four of them had, in addition, paralysis of the sixth nerve. Pain was often so severe that trigeminal tractotomy was performed in one case and in three others the trigeminal ganglion was injected, but in all cases these procedures produced only temporary relief. Facial nerve paralysis and eighth nerve deafness were seen in the only patient with a secondary in the temporal bone. Involvement of the remaining cranial nerves was not noted.

Almost all the patients complained of headaches at one time or another, and in varying degrees of severity. This was often due to secondary infection of the sinuses, but in thirteen cases who had severe persistent and almost progressive headaches it is felt that the cause was raised intracranial pressure due to intracranial spread of the tumour, or possibly secondaries in the brain.

Other signs of intracranial extension and damage were convulsions and epileptic fits. These occurred in three patients. One patient had a very extensive squamous carcinoma which extended from the sinuses through to the anterior cranial fossa. This patient developed generalized convulsions and the CSF pressure was raised to 220 mmHg. After treatment with intravenous cyclophosphomide, the convulsions subsided.

Paralyses were not restricted to the cranial nerves alone. There were two patients who developed hemiplegia. One other case with a squamous carcinoma of the right ethmoid developed a right hemiplegia which recovered in about 4 weeks. In this case, it was felt that the paralysis might be due to cerebral thrombosis rather than to the effect of extension of the tumour.

Another observed feature was mental change. This was noticed in four patients, all of whom died in hospital. They become disorientated and confused for about a week and finally went into coma. But

there has been one case whose abnormal behaviour was considered by the psychiatrist to be due to exhaustion syndrome caused by pain, pyrexia and lack of sleep rather than to spread of tumour. The central nervous system in this case was otherwise normal.

Meningitis also occurred in some patients, but these were surprisingly few considering the number in which there was obvious direct spread from an infected area into the cranial cavity. One of the three patients who developed this feature is still alive 5 years after he was first diagnosed. In the second case, meningitis occurred 2½ years after the original treatment, at a time when it was also noted that the lesion had recurred. This patient, a middle-aged female, recovered, but there was residual paralysis of the pharynx and palate.

Comment

Though the widely held impression of tumours of the nose and paranasal sinuses is that they are slowly progressive and remain localized for long, the results of treatment have been generally poor. The reason for this may be the presence of unsuspected visceral metastases and intracranial spread, as relatively little is known of the terminal pathology of these tumours. This is supported by the finding of an unexpectedly high rate of metastases on necropsy. Thus Hoye *et al.* (1962) found brain invasion in two out of five necropsies. Braund & Martin (1941) found distant metastases in five out of fourteen cases and O'Brien *et al.* (1971) in three out of seven cases. Compared with this, in clinical reports Dodd *et al.* (1959) found only five out of 123 cases had distant metastases, two of them in the brain. Frazell & Lewis (1963) in a review of 416 patients found that only in fourteen (3·36%) was the disease too far advanced for treatment, in some of them presumably due to intracranial spread and metastases. Among the patients followed up after treatment, forty-two were found to have developed metastases, and a few that were considered as cured during life, were later found to have metastases on necropsy. It is, however, difficult to compare these results with our series or even amongst themselves and with other reports, since there is considerable variation in the method of study, choice of material and criteria. Thus most of the workers consider merely the epidermoid carcinoma or restrict their study practically to necropsy cases only. Some workers include both clinical and necropsy material. There is usually selection of cases in which necropsy is requested, and the number of cases included in some series is rather small and the findings could be overestimates.

Among the forty-one patients with intracranial extension the average age in males was 45 years, and higher than the rest, whose average was 43 years, while in the females it was lower, being 38 years compared with 42·4 years for the rest. As the recorded age of many of our patients is a rough estimate, this difference may not be significant. It has, however, been reported by Braund & Martin (1941) that the patients with secondaries from tumours of the nose and sinuses were mainly younger than those in whom the disease remained localized, and the duration from onset to treatment and onset to death was much shorter. Ringertz (1938) also found that the duration of history was not longer in the cases with metastases.

As, with radical surgery using the craniofacial approach, greater success is being reported in the treatment of even advanced malignancies more attention needs to be given to the assessment of the frequency and extent of intracranial spread and distant metastases for proper selection of cases for surgery. Although tomograms are of considerable help they do not give full information on the topographical extent of the tumours. Pneumography was not found useful to visualize the cribriform plate and ethmoid area by Van Buren, Ommaya & Ketcham (1968), and our experience with the few patients who had pneumography or internal carotid angiography has been the same.

The symptoms of persistent headaches, confusion or mental change, optic atrophy, facial pain and sixth cranial nerve palsy are highly suggestive of intracranial spread of the tumour. Absence of metastases in the cervical nodes does not rule out secondaries in the brain or elsewhere. Only eight of our forty-one patients had palpable cervical nodes.

To get an accurate picture of the frequency of involvement of the central nervous system in tumours of the nose and paranasal sinuses it is necessary to arrange for necropsy on all cases that attend for treatment, and to examine the brain also in all of them. Secondaries in the brain can remain symptomless and undetected and may be missed if the brain is examined only in those patients who had shown clinical evidence of intracranial involvement (Willis, 1952).

References

BRAUND, R.R. & MARTIN, H.E. (1941) Distant metastases in

carcinoma of the upper respiratory and alimentary tracts. *Surgery Gynec. Obstet.* **73**, 63–71.

DODD, G.D., COLLINS, L.C., EGAN, R.L. & HERRERA, J.R. (1959) The systemic use of tomography in the diagnosis of carcinoma of the paranasal sinuses. *Radiology*, **72**, 379–392.

EDINGTON, G.M. & MACLEAN, C.M.U. (1965) A cancer rate survey in Ibadan, Western Nigeria. *Brit. J. Cancer*, **19**, 471–481.

FRAZELL, E.L. & LEWIS, J.S. (1963) Cancer of the nasal cavity and accessory nasal sinuses. *Cancer*, **16**, 1293–1301.

HOYE, R.C., HERROLD, K. McD., SMITH, R.R. & THOMAS, L.B. (1962) A clinicopathological study of epidermoid carcinoma of the head and neck. *Cancer*, **15**, 741–749.

O'BRIEN, P.H., CARLSON, R., STEUBNER, E.A., & STALEY, C.T. (1971) Distant metastases in epidermoid cell carcinoma of the head and neck. *Cancer*, **27**, 304–307.

RINGERTZ, N. (1938) Pathology of malignant tumours arising in the nasal and paranasal cavities and maxilla. *Acta Otolar.* Suppl. 27.

VAN BUREN, J.M., OMMAYA, A.K. & KETCHAM, A.S. (1968) Ten years experience with radical combined craniofacial resection of malignant tumours of the paranasal sinuses. *J. Neurosurg.* **28**, 341–350.

WILLIS, R.A. (1952) *The Spread of Tumours in the Human Body*, p. 254. Butterworth, London.

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