Endoscopic Excision of Sino-nasal Tumours

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INTRODUCTION

Endoscopic sinus surgery has largely replaced conventional operative approaches in the treatment of most forms of rhinosinusitis and is increasingly applied to a range of other sinonasal conditions previously undertaken via an external approach. This list includes orbital and optic nerve decompression, the drainage of mucoceles, the repair of CSF leaks and ligation of the sphenopalatine artery. For all of these the same results can be achieved endoscopically often with a reduction in morbidity in terms of hospital stay and the avoidance of fa-

cial scars. However, the use of an endoscopic approach to the management of neoplasia remains controversial.

DIAGNOSIS AND FOLLOW UP

There is no question that the endoscope is extremely useful in the diagnosis and biopsy of sinonasal neoplasia, enabling earlier detection of tumours and the ability to take direct biopsy without transgressing normal tissue planes with its attendant risk of "seeding of tumour". Indeed an endoscopic approach is by far the most superior in obtaining tissue from cases such as these (Figs 1, 2).

The examination and biopsy can be performed under local anaesthesia or a combination of local and general anaesthesia though under either circumstance it is mandatory to obtain representative tissue of the tumour and not the inflammatory response that often is associated with it.

In dealing with tumours of the sinonasal area, it is important to realise that it is the area of greatest histologi-

Fig. 1 Coronal CT showing chondrosarcoma ideal for endoscopic biopsy

Fig. 2 Axial CT scan of sphenoidal meningioma ideal for endonasal endoscopic biopsy

cal diversity¹⁾ in the body and it is necessary to utilise the services of an expert histopathologist in making an accurate diagnosis which will have a direct bearing on the modalities and nature of subsequent therapy. Similarly access to expert imaging, both CT and MRI, is paramount in determining the extent of the tumour to ensure that the correct approach is chosen.^{2,3)}

The endoscope is also invaluable for post therapy follow up, enabling early detection and possible further excision or delivery of palliative treatment. This again should be combined with regular and expert imaging *e. g.* the use of subtraction of T1 spino echo images with and without gadolinium to define recurrence in areas inaccessible to direct visualisation such as the soft tissues of the cheek or intracranial extension as well as accurately directing a biopsy from the surgical cavity.⁴⁾

TREATMENT

Benign

Inverted papilloma

A range of benign lesions treated endoscopically have been reported in the literature (Table 1) of which the commonest is inverted papilloma. Considerable interest has surrounded the ability of inverted papilloma to recur and undergo malignant transformation. In the literature recurrence rates of between 0 and 75% are quoted⁵ although the term “recurrence” merely indicates residual disease in the majority of cases and is directly related to the surgical approach and the care with which the papilloma is removed.

The issue of malignant transformation has also been exaggerated. Whilst a range of 0 to 53% is found in the literature⁵⁾ it is clear on reviewing those papers claiming the higher rates of malignancy that well differentiated squamous cell carcinoma was present *ab initio* in the

majority of cases. In a study of 123 cases conducted at the Institute of Laryngology and Otology the proven malignant transformation rate was under 2%. However, notwithstanding these remarks it is important that an inverted papilloma is removed in its entirety if only to ensure that patients are not subjected to repeated surgical interventions over a number of years.

As a consequence it is important to confirm the histology and determine the extent usually by CT, sometimes combined with MRI to further elucidate the extent of tumour within the frontal or maxillary sinuses which distinguishes papilloma from retained secretion and/or inflammation⁶. Classically inverted papilloma arises within the middle meatus and dumb bells into adjacent sinuses often associated with a heterogeneous opacification and sclerosis in adjacent bone. (Figs. 3, 4) Unless this adja-

Fig. 3 Coronal CT scan of inverted papilloma presenting in middle meatus, ideal for endoscopic resection

Fig. 4 Coronal CT scan of inverted papilloma involving frontal sinus not to accessible an entirely endoscopic approach

TABLE 1 Benign lesions resected endoscopically

BENIGN TUMOURS RESECTED ENDOSCOPICALLY
• papillomas (inverted, everted, cylindric)
• adenoma, (monomorphic and pleomorphic)
• angiofibroma
• osteoma and fibro-osseous lesions
• neurolemmoma, neurofibroma
• fibroma, lipoma, myxoma, leiomyoma, rhabdomyoma
• pituitary tumours

cent bone is surgically accessible and resected, the tumour may be left behind.

Surgery is the agreed primary therapeutic modality of choice and a range of surgical approaches have been described. In a personal series of 55 cases with a follow up of 1 to 10.5 years (mean 58 months) 25 were treated by an exclusively endoscopic approach whilst 30, 18 of whom had undergone previous surgery, were treated by a combined endoscopic and an external approach. In all 25 cases treated endoscopically the nasal cavity, anterior ethmoids and medial maxilla were involved with limited extension into the sphenoid and frontal sinus. In the combined group a variety of external approaches were used (Table 2). In this group the previous surgery included intranasal polypectomy (6 on multiple occasions) and lateral rhinotomy (8; 1 to 3 times/patient). Recurrence occurred in two cases (8%) treated endoscopically and in 6 cases (19%) treated by the combined approach, the majority having undergone previous surgery including multiple polypectomy, in some cases over a number of years prior to the diagnosis being made. This underlines that the first operation offers the best chance of

cure and also the need to routinely submit tissue for histology. Inverted papilloma may occur in association with benign polyposis which may mask the usual unilaterality of the condition and indeed can, albeit rarely, occur in both sides of the nose.

Not surprisingly limited surgery such as conventional polypectomy is associated with ‘recurrence’ rates of up to 75%⁷⁾. This is clearly residual disease and led to popularisation of external approaches such as lateral rhinotomy and midfacial degloving accompanied by commensurately lower recurrence rates of between 0 and 29%. Since the 1980s a number of authors have employed an endoscopic approach in appropriate cases again reporting a similar order of ‘recurrence’. When the cases in 31 series reported between 1977 and 2003 are aggregated a cohort of over 1500 patients may be reviewed (Table 3) and demonstrate comparable recurrence rates from both external and endoscopic approaches. This obviously includes a bias due to patient selection based on extent of disease.

What then determines the choice of an endoscopic approach? It is clear that when tumour invades the frontal

TABLE 2 Inverted papilloma : personal series 1987–2002

INVERTED PAPILLOMA

Surgical approaches, previous surgery and recurrence rates in present series (1987–2002)

n = 55

Approach	N	Previous surgery	Recurrence
Endoscopic alone	25	4	2 (8 %)
Endoscopic + external	30	18	6 (19%)
+ External fronto-ethmoidectomy	4		
+ Caldwell Luc	5		
+ Lateral rhinotomy	10		
+ Midfacial degloving	11		

TABLE 3 Inverted papilloma : Overall recurrence rates in published series 1977–2003

Overall recurrence rates in published series between 1977 and 2003^{8–32}

n = 1574

Conservative (INP, INE, C/L)	240/413	58%
External (LR, MFD)	110/764	14%
Endoscopic : alone	70/369	19%
combined	17/ 83	20%

INP : intranasal polypectomy, INE : intranasal ethmoidectomy, C/L : Caldwell–Luc
LR : Lateral rhinotomy, MFD : midfacial degloving

sinus, lateral maxillary wall, nasolacrimal region, orbit and/or skull base, the chances of inadequate excision are considerably increased and it is thus the extent of disease which primarily determines the optimum of surgical approach. However, it may only be possible at operation to absolutely define whether the papilloma has infiltrated the mucous membrane or simply “dumb belled” into the sinus with associated retention of secretion and it may be necessary to warn the patient that the final choice of procedure may be decided at the time of surgery. Under these circumstances, a combination of endoscopic and external approaches may be successfully employed.

Juvenile angiofibroma

This tumour which uniquely affects young males, is characterised by a potential for massive haemorrhage and relatively high “recurrence” rates. It originates in the region of the sphenopalatine foramen, initially eroding the upper part of the medial pterygoid plate and has characteristic features on imaging which preclude the need for pre-operative biopsy³³⁾. The transpalatal approach has largely been abandoned in favour of lateral rhinotomy and mid facial degloving in the largest series^{34, 35)}. A careful assessment of the imaging of recurrent cases highlighted infiltration of the basisphenoid³⁶⁾ Subsequent to this observation a specific attempt has been made to drill out this area following which the recurrence rate has dropped from 21% to 0%³⁷⁾.

Something in excess of 50 cases have been reported in the literature managed by an entirely endoscopic approach. All authors agree that only selected small/moderate lesions are amenable to such a technique (Stage I or Stage II) according to the Chandler classification³⁸⁾, pre-operative embolisation is mandatory and the expertise to convert to a more extensive procedure during the operation a prerequisite. If these caveats are observed a recurrence rate of <10% has been reported with follow-up in excess of 1 year and up to 7 years³⁹⁻⁴⁵⁾.

Fibro-osseous and osteomas (Table 4)

A small number of small osteomas and miscellaneous fibro-osseous lesions have been approached endoscopically. The evidence that small osteomas produce headaches in the absence of an associated sinus infection is lacking and thus the indication for their surgical removal is somewhat debatable. Nonetheless technically there

TABLE 4 Bening fibro-osseus lesions : personal series
PERSONAL SERIES OF BENIGN FIBRO-OSSEOUS LESIONS (1978–2003)

n = 61*	
Age range : 2–75 years	
Mean 27 years	
Sex : male : female 2. 4 : 1	
Referred :	
ophthalmologist : 44%	
otolaryngologist : 56%	
Symptoms :	
proptosis	
diplopia	
visual loss and/or epiphora	
Pathology :	
Osteoma	25
Ossifying fibroma	17
Fibrous dysplasia	7
Other <i>e. g.</i> osteoblastoma	12

*Only 1 managed by ESS

TABLE 5 Malignant lesions resection endoscopically
MALIGNANT TUMOURS RESECTED ENDOSCOPICALLY

- olfactory neuroblastoma
- malignant melanoma
- adenocarcinoma
- transitional cell carcinoma (nasolacrimal)
- adenoid cystic carcinoma
- squamous cell carcinoma
- chondrosarcoma
- chordoma

are some cases which may be approached in this way. The largest series reported was by Draf in which 35 lesions, 28 of which were osteomas were removed with a follow-up of 1 to 7 years and no recurrences^{43, 46-49)}.

Schwannoma

There are one or two cases of neurogenic tumours have been reported in the literature removed endoscopically, in one case with 4 years follow up⁵⁰⁾.

MALIGNANT TUMOURS

During recent years the use of endoscopic surgery for a range of malignant tumours affecting the nasal cavity and skull base have also been reported in the literature (Table 5) which is far more controversial. Malignant tumours of the nose and sinuses are rare, occurring in less than 1/100,000 of the population and constituting <3% of head and neck cancers. This means that the av-

TABLE 6 Results of craniofacial resection in series of 209 patients

Actuarial survival for whole group and individual histologies undergoing craniofacial resection ¹			
Histology	5yr (%)	10yr (%)	n
Overall	51	41	209
Benign	75	75	44
Malignant	44	32	155
Adenocarcinoma	43	38	42
Olfactory neuroblastoma	62	47	26
Squamous cell carcinoma	32	32	25
Chondrosarcoma	79	47	19
Adenoid cystic carcinoma	51	36	15

erage ENT surgeon will see only a very few cases during their career. As already stated, although squamous cell carcinoma is the commonest malignant tumour, every possible histological type of neoplasia can occur in the nose and sinuses and many of these tumours behave in a highly idiosyncratic way. The close proximity of the orbit and, more importantly, the anterior cranial fossa already compromise our ability to oncologically resect these tumours and we and the patient may have only one opportunity to surgically encompass the disease which by its very nature is often symptomatically silent whilst being extensive at presentation. A craniofacial resection combined with radiotherapy where appropriate has become the “gold standard” for tumours which have transgressed the anterior skull base⁵¹⁾.

A recent analysis of 209 patients who underwent this procedure between 1979 and 1995 included a large group of adenocarcinoma (42), olfactory neuroblastoma (26 cases) and chondrosarcoma (19 cases). The actuarial survival at 5 and 10 years for the cohort as a whole and for these pathologies is shown in Table 6. The follow up as a whole ranged from 1 to 17 years with a mean of 52 months. A multivariate analysis and Cox regression analysis identified three factors which significantly affected both outcome and survival for the patient.

These were malignant histology, brain involvement including the dura and orbital involvement including orbital periosteum. Involvement of the frontal lobe was particularly devastating with an inevitably rapid demise within a year even when the area of brain was resected.

A recent review of 42 patients with olfactory neuroblastoma treated with craniofacial resection showed improved actuarial survival of 77% at 5 years and 53% at 10

years⁵²⁾. Local recurrence occurred in 17% of individuals between 12 and 144 months following the surgery (mean 37 months) and was higher (28%) with craniofacial alone versus craniofacial plus radiotherapy (4%). Thus the results of endoscopic surgery must be compared with cohorts such as these, not at 1 or 5 years but at 10 and 20 years as the natural history of these tumours may extend over a life time.

In Wigand’s series⁵³⁾ of endoscopically resected malignant tumours, the cases were mainly adenocarcinoma or olfactory neuroblastoma with survival rates of under 40% at 5 years and it was his view that where resection of the orbital periosteum or more than small amounts of dura were required, a craniofacial approach was necessary. It is mandatory to assess invasion of these areas and deal with them as well as controlling the potential operative complications of haemorrhage and large CSF leaks. Notwithstanding these remarks there may be individual patients for whom an endoscopic resection does offer the best treatment and the additional need for radiotherapy for example in olfactory neuroblastoma is not outwith our present practice. A similar situation exists in malignant melanoma where the surgical approach does not appear to materially alter survival rates⁵⁴⁾ and thus, endoscopic resection may be considered in often elderly patients (Fig. 5).

Stammberger, Draf and the Belgian group have described cohorts of malignant tumours including both adenocarcinoma and olfactory neuroblastoma^{43, 45, 55, 56)}. However, follow up has been relatively short, in the case of olfactory neuroblastoma described by Stammberger, a mean of 34 months. In the Belgian series of 66 patients treated between 1992 and 1999, 25% recurred locally and

Fig. 5 Endoscopic view of malignant melanoma amenable to an endoscopic resection

TABLE 7 Endoscopically excised malignant tumours : personal series 1997–2003

ENDOSCOPICALLY EXCISED MALIGNANT TUMOURS (PERSONAL SERIES 1997–2003)	
n = 23	
Age range : 34–88 years	
Mean : 73 years	
Sex : male : female 12:11	
Follow up : 6–66 months	
Mean 24 months	
Histology	
adenocarcinoma	7
malignant melanoma	6
olfactory neuroblastoma	4
malignant schwannoma	1
transitional cell carcinoma	1
adenoid cystic carcinoma	1
squamous cell carcinoma	1
chondrosarcoma	1
chordoma	1
Number converted to craniofacial resection 2 (1 olfactory neuroblastoma, 1 transitional cell carcinoma)	

a further 7% had local and distant metastases rendering a recurrence rate of 35%. As this is a very mixed group of histology, extent and follow up it is difficult to make direct comparisons with other series. My own series (Table 7) in common with these colleagues is a heterogeneous mix of pathologies with relatively short overall follow up. However, the close post-operative scrutiny has allowed two early 'recurrences' to be detected and dealt with by craniofacial resection.

An alternative approach is to combine an intranasal

endoscopic resection with an external craniotomy, which if performed through a bifrontal incision provides excellent cosmesis⁵⁷⁾. In addition to curative excision an endoscopic approach may be utilised in palliative therapy either for surgical debulking, the insertion of radioactive implants or the combined with use of a laser. These may all diminish the morbidity of more extensive approaches and often allow the patient to be treated on a day case basis.

CONCLUSION

The use of the endoscope has enormously enhanced our ability to deal with many sinonasal pathologies including neoplasia. In the case of benign tumours only the extent of the tumour limits our ability to deal with them endoscopically but in so doing we must have to hand the full armamentarium of other surgical procedures in case endoscopic resection is not possible. The issue of curative endoscopic resection for malignant tumours is open to debate and will remain so for some time related to the natural history of the conditions themselves.

Malignant tumours occur infrequently and may have natural histories extending over 15 to 20 years so it will be difficult to make meaningful comparisons between entirely endoscopic approaches and procedures such as the craniofacial resection. This procedure has doubled the survival rate during the last 20 years for pathologies such as olfactory neuroblastoma probably because the craniofacial approach provides the ability to resect the olfactory bulbs and tracts into which microscopic disease can spread undetected by even the most sophisticated imaging. Marked difference in survival of 37.5% compared to 82% was found when Levine et al⁵⁸⁾ et al divided their patients into those treated without and those with craniofacial resection respectively. We must not sacrifice the chance of cure in our pursuit to reduce morbidity and patients must be fully informed and available for long term follow up with imaging and biopsy (Fig. 6a–c). Finally, these cases should only be tackled by those surgeons with an extensive experience of sinonasal neoplasia, expertise in endoscopic techniques and the ability to convert to more extensive procedures if required.

Fig. 6a Axial MRI (T₁ with Gad DTPA) adenocarcinoma potentially amenable to endoscopic resection

Fig. 6b Post-operative MRI scan of surgical cavity 3 years showing no recurrence

Fig. 6c Endoscopic appearances of surgical cavity following endoscopic resection

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