A clinicopathological review of spinal ependymomas in Northern Ireland

A M Carragher, M K Heatley, M Mirakhur, I C Bailey

Accepted 22 November 1989.

SUMMARY

Of eighty-three tumours of ependymal origin diagnosed in the twenty years 1969–1988 in Northern Ireland, fifteen were located within the spine. Two were in children, 13 in young adults with a mean age of 33 years. 70% presented with back pain and 60% had weakness of the lower limbs. Survival was found to correlate well with histological grading (WHO classification). The mean time of survival for tumours graded 1/2 was six years; there were three long-term survivors of 13, 17 and 18 years; 90% of the patients survived 2·5 years.

INTRODUCTION

Ependymomas arise from the cells lining the cerebral ventricles and the central canal of the spinal cord. There is a very wide variation in the proportion of cases reported as arising from the spinal cord. In most series, the vast majority of ependymomas arise within the cranial cavity, especially in children, and only a small proportion are of spinal origin. Clinicopathological series with large numbers of patients usually emanate from tertiary referral centres and therefore may not reflect the true geographical distribution of these tumours in a defined population. The Departments of Neurological Surgery and Neuropathology at the Royal Victoria Hospital, Belfast provide the regional services for the 1·5 million population of Northern Ireland, so that all cases diagnosed as ependymoma will pass through one or both of these departments.

MATERIALS AND METHODS

The frequency of occurrence of spinal cord ependymomas from 1 January 1969 to 31 December 1988 was found from the records of both departments. There were 83 tumours of ependymal origin of which 15 (18%) were in the spinal cord. The clinical and neuropathological material presented is taken from those patients whose diagnosis was confirmed as spinal cord ependymoma on histopathological review. Operative death was defined as occurring within 30 days of a surgical procedure. Follow-up was determined up to 31 December 1988, in some instances by contact with the patients' general practitioner.

Department of Neurological Surgery, Royal Victoria Hospital, Belfast BT12 6BA.
A M Carragher, FRCS, Registrar.
I C Bailey, FRCS, Consultant Neurosurgeon.
Department of Pathology, The Queen's University of Belfast, Institute of Pathology, Belfast BT12 6BJ.
M K Heatley, MB, BCh, BAO, Registrar.
M Mirakhur, MD, MRCPath, Consultant Neuropathologist and Histopathologist.
Correspondence to Mr Bailey.

© The Ulster Medical Society, 1990.
RESULTS

There were 15 ependymomas of the spinal cord or cauda equina. Age at diagnosis ranged from 5 to 58 years, mean 33 years. Only two children were identified, aged 5 and 13 years. There were nine male and six female patients, male/female ratio 1.5:1.

The commonest complaints were low back pain in 11 (73%), and weakness of the lower limbs in five (33%). On examination nine (60%) had lower limb weakness. A long delay from symptom onset to establishment of the true diagnosis was not uncommon, varying from one month to 12 years (mean 2.5 years).

Myelography was the principal diagnostic investigation, in recent years replaced by computerised tomography with myelographic enhancement (CT myelogram). In all cases decompressive laminectomy was performed, total removal of the tumour being achieved in six patients (40%). In one instance, only a tumour biopsy was possible and this patient died three weeks after surgery, the only operative death in the series. Seven patients received postoperative radiotherapy because tumour removal was incomplete. In four there was subsequent tumour recurrence necessitating a second operation; two of these had received radiotherapy. The mean time from primary diagnosis to recurrence was 13 months, range three to 33 months.

Neuropathology

Nine tumours (60%) were variously distributed within the spinal cord; six (40%) were confined to the conus, cauda equina and filum terminale. One tumour stretched from the cervical region to the conus (Table I).

| Table 1: Anatomical location of 15 spinal ependymomas diagnosed 1969–1988 |
|-----------------------------|-----------------------------|
| Cervical                    | 1                           |
| Thoraco-lumbar              | 3                           |
| Lumbar                      | 4                           |
| Cervical to conus           | 1                           |
| Conus                       | 2                           |
| Cauda equina                | 3                           |
| Filum terminale             | 1                           |

Routine haematoxylin and eosin staining was sufficient to confirm the diagnosis in most cases, which were well differentiated with regular features. Immunohistochemical staining for glial fibrillary acidic protein (GFAP), and electron microscopy were used to confirm the ependymal nature of the poorly differentiated examples. Histologically, most were well differentiated with a regular cellular pattern and cytological features indicative of low malignant potential. The tumours were graded according to the World Health Organisation system. This grading correlated well with survival times. Of the two tumours classified as Grade III, one survived 2.5 years. One very poorly differentiated tumour was assigned to Grade IV, and came closest to the concept of a primitive neuroectodermal tumour (PNET) (Table II).
The symptoms of spinal ependymomas can be subtle and often mimic those of other neurological conditions. The common presenting features include back pain, limb weakness, and gait disturbances. Intra-tumoral haemorrhage is common and results in sudden neurological deterioration. The presence of a mass effect on adjacent neural structures can also cause symptoms such as bowel and bladder dysfunction.

All of those patients whose tumour was classified histologically as Grade I were alive and well on 31 December 1988. One with a Grade II tumour had died three years after surgery from an unrelated cause (confirmed by autopsy). In addition to the postoperative death one other patient with a Grade III tumour had died one and a half years after treatment.

DISCUSSION

The incidence of spinal ependymomas as a percentage of all ependymomas during the 20 years of this study was 18%, which represents the incidence of this condition in the population in Northern Ireland. Four patients were diagnosed in the first decade and eleven in the second which suggests a rising frequency although the numbers are small. In a national survey from Norway, Mork and Loken\(^2\) reported that spinal tumours represented 53% of all ependymomas, Illgren et al\(^3\) reported a proportion of 41% from Oxford, and Barone and Elvidge\(^4\) from Montreal found 37%. In common with other studies,\(^2\), \(^3\), \(^4\), \(^5\) we found that children rarely developed spinal ependymomas and that the mean age at the time of diagnosis was 33 years. The male : female ratio of 1.5 : 1 is comparable with that found in other series.\(^6\)

Predictably, most patients presented with back pain, usually in the lumbar region, together with lower limb weakness and a vague sensory loss below the level of the tumour. Because of the slow growth of the tumour, delays in making a diagnosis were common, as long as 12 years. Cooper and Epstein\(^7\) record a mean duration of symptoms of ependymoma of 8.3 years, and compare this with the duration of symptoms of intramedullary astrocytoma which range from 15 years for Grade I tumours, 10 years for Grade II, to only 0.8 years for Grade III/IV tumours.

Spinal ependymomas are most commonly found in the region of the conus medullaris or the cauda equina. They are often quite large when first discovered and can extend over several neural segments. Cooper and Epstein\(^7\) found the mean length as 4.7 segments. In our group, 40% were located in the region of the cauda equina. Mork and Loken\(^2\) found 53% of the tumours in the spinal cord and 45% adjacent to the cauda equina. In none of our patients was there a sign of another primary tumour in the posterior cranial fossa, so that none was the result of seeding to the spine from a tumour at a higher level in the neural axis. Ependymomas are almost always well circumscribed and demarcated. In the spinal cord they are usually well defined, elongated intramedullary masses that can often be shelled out at surgery. However, the ependymal cells are embryological derivatives of primitive neuroectodermal cells and occasionally the tumours assume this very malignant form.

\(^*\)Death unrelated to tumour.
\(^*\)Death related to tumour.

| Grade | No of patients | Outcome | Survival (years) |
|-------|----------------|---------|-----------------|
| I     | 4              | All alive | 2.5 - 17.0     |
| II    | 8              | 1 dead*  | 2.5 - 17.5     |
| III   | 2              | 1 dead** | 1.5 - 2.5      |
| IV/PNET | 1              | 1 dead  | postoperative death at 3 weeks |

© The Ulster Medical Society, 1990.
Survival and histological grading correlated very well. Of the three deaths two can be related to tumour, one of these being Grade IV (primitive neuroectodermal tumour) who died three weeks postoperatively. The second patient died from a Grade III tumour 1·5 years after operation. Those whose tumours were graded I or II had a mean survival time of six years, with three long term survivors, 13·0 to 17·5 years. Ninety percent of all our patients were alive at least two and a half years after the diagnosis was made.

REFERENCES
1. Zülch KJ (ed). Histological typing of tumours of the central nervous system. Geneva: World Health Organisation, 1979: 19-24.
2. Mork SJ, Loken AC. Ependymoma: a follow-up study of 101 cases. Cancer 1977; 40: 907-15.
3. Ilgren EB, Stiller CA, Hughes JT, Silbermann D, Skeckel N, Kaye A. Ependymomas: a clinical and pathologic study. Part 1: Biologic features. Clin Neuropathol 1984; 3: 113-21.
4. Barone BM, Elvidge AR. Ependymomas. J Neurosurg 1970; 33: 428-38.
5. Dohrmann GJ, Farwell JR, Flannery JT. Ependymomas and ependymoblastomas in children. J Neurosurg 1976; 45: 273-83.
6. Sonneland PRL, Scheithauer BW, Onofrio BM. Myxopapillary ependymoma: a clinicopathologic and immunocytochemical study of 77 cases. Cancer 1985; 56: 883-93.
7. Cooper PR, Epstein F. Radical resection of intramedullary spinal cord tumours in adults. Recent experience in 29 patients. J Neurosurg 1985; 63: 492-9.

© The Ulster Medical Society, 1990.