Research Paper

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Diagnostic Accuracy of Intraoperative Frozen Sections in Central Nervous System Lesions at a Tertiary Care Centre, Ahmedabad, India.

Medical Science

KEYWORDS : Frozen Sections, Central Nervous System Lesions

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ABSTRACT

BACKGROUND AND AIMS: Intraoperative consultation of CNS lesions provides accurate diagnosis to neurosurgeons. Some lesions, however, may cause diagnostic difficulty. In this study accuracy of intraoperative consultations of CNS lesions and discrepancies in diagnosis were analysed.

METHODS: All CNS cases from April, 2014 to October, 2015 in which intraoperative frozen section had been performed, and which were reported in the Section of Histopathology, Civil Hospital Ahmedabad were retrieved. The diagnosis given on FS were compared with the final diagnosis given on permanent paraffin sections (and additional material if received), as indicated in the frozen section and final pathology report.

RESULTS: During the study period, 124 CNS cases were received for intraoperative consultation. In all cases, cryostat sections (FS) plus cytology smears were prepared. The ages of the patients ranged from 1 month to 78 years. 76 were males and 48 were females. Out of these 124 cases, 109(87.9%) cases were concordant,15 cases (12.1%)were discrepant. The diagnostic accuracy of frozen section was 87.9%. 3(20%)of 15 discrepancies involved errors in classification of spindle cell lesions, most commonly confusing schwannomas with fibroblastic meningiomas. 4(26.6%) cases involved errors in differentiating astrocyomas from medulloblastoma and oligodendrogliomas. 2(14.4%) cases involved errors in differentiating reactive from neoplastic processes, most frequently gliosis versus glioma. 3(20%) discrepancies involved errors in the grading of tumors. The remaining 3 (20%) cases included an assortment of other discrepancies.

CONCLUSIONS: Our results show a reasonably high percentage of accuracy in the intraoperative diagnosis of CNS lesions. However, there are limitations and some lesions pose a diagnostic challenge. There is a need to improve our own diagnostic skills and establish better communication with neurosurgeons.

Introduction:

The rapid diagnostic evaluation at FS may guide intraoperative management, which may be particularly important during open craniotomy.[5,19] In addition, FS allows for the appropriate triage of tissue for ancillary studies such as electron microscopy, microbiologic cultures, and frozen tissue storage.[2,4,5,19] The role of the neuropathologist in interpreting CNS FS is to assist the neurosurgeon, along with clinicoradiologic correlation, in making the most accurate judgment regarding the nature of the CNS lesion.

The major criteria for requesting an intraoperative diagnosis vary but the major criteria include the following: (i) if intraoperative management will be influenced by the diagnosis (ii) if an unexpected lesion is seen at surgery which is different from what was suspected clinically (iii) if the main aim is to obtain a biopsy diagnosis (iv) to assess margins if radical excision is planned [4,7,18]

In some centers, neuropathologists only employ cytology smears prepared by the "squash method", while in others both cytology and frozen section are employed[17]. The generally soft consistency of most primary CNS neoplasms facilitates the preparation of smears, and smear cytology has been used with great success for the intraoperative diagnosis of CNS neoplasms [1;6,9,10,16,18] , especially astrocytomas, oligodendrogliomas, small round cell tumours etc [17]. Frozen sections are mainly useful for the more firm, rubbery neoplasms such as meningiomas, ependymomas, and most metastatic tumours in which it is difficult to prepare good cytology smears. [1,7,10] Studies have shown that a combination of the two techniques is most beneficial [14]. In our center also, we use a combination of both techniques whenever we get an intraoperative consultation in a suspected case of CNS neoplasm. The diagnostic accuracy of CNS intraoperative consultations has ranged between 85% and 90% in various studies [2,4,5,13,17,18]

The aim of this study was:

(a) to analyse the accuracy of intraoperative consultations of CNS lesions in our practice

(b) to assess the discrepancies in our cases.

Materials and Methods

All CNS cases from April , 2014 to October 2015 in which intraoperative frozen section had been performed, and which were reported in the Section of Histopathology, Civil hospital, Ahmedabad, India were retrieved. The diagnoses given on FS were compared with the final diagnosis given on permanent sections (and additional material if received), as indicated on the frozen section and final pathology report. The FS and permanent section slides of all cases showing discrepancy between the FS diagnosis and final diagnosis given after permanent sections or after examination of additional material received later were retrieved and reviewed. The number and types of discrepancies, including sampling and interpretation errors were determined. Discrepancies were identified as misclassification of two different types of neoplasms, misinterpreting benign lesions as malignant (and vice versa), overgrading a particular neoplasm, and misinterpreting a neoplasm for a reactive lesion and vice versa.

Results

During the study period, 124 CNS cases were received for intraoperative consultation (frozen section). In all cases, cryostat sections (FS) plus cytology smears were prepared. The ages of the patients ranged from 1 month to 78 years. 76 were males and 48 were females. Our results showed a reasonably high percentage of accuracy. Out of these 124 cases, 109 cases (87.9%) were concordant, 15 cases (12.1 %) were discrepant. The diagnostic accuracy was 87.9 %.

Discussion

The accuracy of our FS diagnosis, as shown by the concordance rate of 87.9% compares favourably with internationally published data[2,4,5,13,17,18]

In our cases, the reason for seeking intraoperative consultation was primary diagnosis. All types of primary CNS neoplasms including astrocytomas (including pilocytic astrocytoma and glioblastoma multiforme (GBM), ependymomas, oligodendrogliomas, meningiomas, hemangioblastomas, medulloblastomas, metastatic carcinomas etc were diagnosed. In some

cases, a diagnosis of high grade glioma was given. Non-neoplastic diagnoses such as reactive gliosis, granulomatous inflammation including fungus, were also given. Peripheral nerve sheath tumours such as schwannomas were also diagnosed.

Five general categories of discrepant diagnosis (accounting for nearly 80% of discrepant cases) emerged on review of the 15 discrepant cases in our current series of 124 cases: 3(20%)of 15 discrepancies involved errors in classification of spindle cell lesions, most commonly confusing schwannomas with fibroblastic meningiomas. 4(26.6%) cases involved errors in differentiating ependymomas from medulloblastoma and astrocytoma. 2(14.4%) cases involved errors in differentiating reactive from neoplastic processes, most frequently gliosis versus glioma. 3(20%) discrepancies involved errors in the grading of tumors. The remaining 3 (20%) cases included an assortment of other discrepancies.

Table:1 Summary of diagnosis given at frozen section

Diagnosis	No. of cases	Percentage(%)
Astrocytoma grade II	30	24.19
Anaplastic astrocytoma	5	4.03
Glioblastoma multiforme	10	8.06
Pilocytic astrocytoma	2	1.61
Pilomyxoid astrocytoma	1	0.8
Oligodendroglioma	9	7.25
Ependymoma	11	8.87
Meningioma	26	20.96
Schwannoma	8	6.45
Medulloblastoma	3	2.41
Neuroblastoma	1	0.8
Pituitary adenoma	4	3.22
Lymphoma	4	3.22
Central neurocytoma	1	0.8
Ganglioglioma	2	1.61
Anaplastic oligoastrocytoma	1	0.8
Chroid plexus tumors	4	3.22
Metastatic adenocarcinoma	2	1.61
Total	124	100

Table:2 Summary of Details for Discrepant Cases

Frozen diagnosis	Final Diagnosis	No. of cases
Fibroblastic Meningioma	Schwannoma	2
Schwannoma	Fibroblastic meningioma	1
High grade glioma	Medulloblastoma	1
High grade glioma	Oligodendroglioma	1
Astrocytoma Grade II	Oligodendroglioma	1
Medulloblastoma	High grade Glioma	1
Low grade glioma	Reactive gliosis	1
Radiation induced gliosis	Recurrent glioma	1
High grade glioma	Low grade glioma	2
High grade glioma	Cellular ependymoma	1
Glioblastoma	Metastatic carcinoma	1
Epidermoid cyst	Craniopharyngioma	1
Ependymoma	Medulloblastoma	1

Spindle Cell Lesions

Distinguishing meningiomas, peripheral nerve sheath tumors, and other spindled cell proliferations can be challenging at FS, particularly with limited submitted tissue or tissue distorted by crush artifact or cautery. Both meningiomas and schwannomas commonly arise in the cerebellopontine angle region and can show a predominantly benign, spindled cell appearance, thick-walled vessels, abundant collagen, and perivascular whorling. Although degenerative atypia ("ancient" change) is classically characteristic of schwannomas, meningiomas can demonstrate prominent nuclear pleomorphism at times. In addition, some meningiomas lack whorling, psammoma bodies, or cytoplasmic protrusions [3] features that are typically used in making the diagnosis.

Astrocytoma v/s oligodendroglioma and medulloblastoma

In one instance, a high grade (grade III) astrocytoma was reported as medulloblastoma.

A diagnosis of "glioma" along with indication of the differential diagnosis and some indication of grade is usually adequate at FS. There are some differences regarding grading thresholds between the 2 glioma types that might present a challenge if one is not sure of the tumor lineage. In most instances, stratification into "low grade" (World Health Organization grade II) versus "high grade" (World Health Organization grade III or IV) is sufficient at FS. Histologically, oligodendrogliomas tend to be more cellular and less pleomorphic than astrocytomas. Oligodendroglial tumor nuclei appear round and uniformly hyperchromatic; however, freezing tissue often produces irregularities in the nuclear contours of an oligodendroglioma, making it look similar to an astrocytoma.[3]

Reactive From Neoplastic

Distinguishing between reactive astrocytosis (gliosis) and a low-grade glial neoplasm is one of the most difficult differential diagnostic challenges in surgical neuropathology. It is common to find at least some degree of gliosis adjacent to and associated with a tumor. Microscopically, the hypercellularity observed in gliosis, because of reactive astrocytes, tends to be evenly distributed, whereas the distribution of neoplastic cells is uneven in tumors. The nuclei of reactive astrocytes are slightly enlarged and eccentrically positioned within abundant, eosinophilic cytoplasm with stellate processes. A low nuclear-cytoplasmic ratio is maintained. Occasional binucleate cells can be encountered. In contrast, many tumor cells found in low grade fibrillary astrocytomas have increased nuclear-cytoplasmic ratios with little discernible cytoplasm. Astrocytoma nuclei have markedly irregular contours with hyperchromasia and unevenly distributed chromatin.

Tumor Overgrading

Frozen section can introduce changes that are not typically seen in paraffin-embedded, permanent sections, making it difficult to accurately assess cellularity and pleomorphism. The most important differentiating features at FS in distinguishing a high-grade glioma from a low-grade glioma are the presence of mitotic figures (especially atypical), tumor cell necrosis, and vascular proliferation.

Conclusion:

Our results show a reasonably high percentage of accuracy in the intraoperative diagnosis of CNS lesions. However, there are limitations and some lesions pose a diagnostic challenge. Hence, there is a need to improve our own diagnostic skills and establish better communication with neurosurgeons.

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