RESEARCH COMMUNICATION

Central Nervous System Lesions: Correlation of Intraoperative and Final Diagnoses, Six Year Experience at a Referral Centre in a Developing Country, Pakistan

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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 and deferrals were analysed. Methods: All CNS cases from May 1, 2004 to September 20, 2010 in which intraoperative frozen section had been performed, and which were reported in the Section of Histopathology, Aga Khan University Hospital, Karachi Pakistan were retrieved. The diagnoses given on FS were compared with the final diagnosis given on permanent sections (and additional material if received), as indicated in the frozen section and final pathology report. Results: During the study period, 171 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 03 to 77 years. 106 were males and 65 were females. Out of these 171 cases, 160 cases (94.1 %) were concordant, 10 cases (5.8 %) were discrepant, and one case was deferred until permanent sections. The diagnostic accuracy of frozen section was 88.9%. The sensitivity and specificity were 94.8% and 87.5% respectively. The positive predictive value was 98.6% and negative predictive value was 63.6%. All our cases in which intraoperative consultation was requested were sent for primary diagnosis. Adequacy per se was not a criterion for sending cases for intraoperative consultation. 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.

Keywords: CNS lesions - intraoperative consultations - diagnostic accuracy - frozen sections - discrepant cases

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Introduction

Intraoperative consultations are becoming increasingly common in suspected cases of central nervous system (CNS) neoplasms. 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 (Di Stefano et al., 1998; Ironside et al., 2002; Yachnis, 2002). In addition with stereotactic biopsies, the primary goal of frozen section (FS) evaluation in a suspected case of CNS neoplasm is to check for adequacy, so that an accurate final diagnosis can later be given (Di Stefano et al., 1998; Yachnis, 2002). In some centers, neuropathologists only employ cytology smears prepared by the "squash method", while in others both cytology and frozen section are employed (Savargaonkar et al., 2001). 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 (Adams et al., 1981; Moss et al., 1997; Shah et al., 1998; Firlik et al., 1999; Kakinuma et al., 2002; Roessler et al., 2002), especially astrocytomas, oligodendrogliomas, small round cell tumours etc (Savargaonkar et al., 2001). 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 (Adams et al., 1981; Folkerth, 1994; Moss et al., 1997).

Studies have shown that a combination of the two techniques is most beneficial (Reyes et al., 1991). 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 (Colbassani et al., 1988;

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Brainard et al., 1997; Di Stefano et al., 1998; Shah et al., 1998; Savargaonkar et al., 2001; Regragui et al., 2003). 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 and deferrals in our cases.

Materials and Methods

All CNS cases from May 1, 2004 to 20th September 2010 in which intraoperative frozen section had been performed, and which were reported in the Section of Histopathology, Aga Khan University Hospital, Karachi Pakistan 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. Cases which were deferred at the time of FS were also retrieved and causes for deferral were determined. A group of nondiscrepant cases were isolated blindly and reviewed by one of the authors. Results were calculated as percent agreement and disagreement, sensitivity and specificity, and positive and negative predictive values. SPSS version 15.0 was used for data analysis. 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, 171 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 03 to 77 years. 106 were males and 65 were females. Our results showed a reasonably high percentage of accuracy. Out of these 171 cases, 160 cases (94.11%) were concordant, 10 cases (5.8 %) were discrepant, and 01 case was deferred until permanent sections. The diagnostic accuracy was 88.9 %. The sensitivity and specificity was 94.8 % and 87.5% respectively. The positive predictive value was 98.6% and negative predictive value was 63.6%. All our cases in which intraoperative consultation was requested were sent for the purpose of primary diagnosis. Adequacy per se was not a criteria for sending cases for intraoperative consulation. The discrepant diagnoses are summarised in Table 1.

Table 1. Summary of Details for Discrepant Cases

Frozen diagnosis	Permanent diagnosis
Glial neoplasm suggestive of ependymoma, grade II	Central neurocytoma, grade II
High grade glial neoplasm	Atypical meningioma, grade II
Glial neoplasm	Hemangioblastoma
Glial neoplasm, to be further characterized	Diffuse large B cell Non Hodgkin's lymphoma (DLBCL)
Medulloblastoma, grade IV	Anaplastic Astrocytoma, grade III
Meningioma, grade I	Schwannoma, grade I
Glial neoplasm	Reactive gliosis
Glial neoplasm	Reactive/ inflammatory
Benign inflammatory lesion	Central neurocytoma, grade II
Malignant neoplastic lesion, Possibly high grade glioma	Extraventricular neurocytoma

Discussion

The accuracy of our FS diagnoses, as shown by the concordance rate of 88.9% compares favourably with internationally published data (Colbassani et al., 1988; Brainard et al., 1997; Di Stefano et al., 1998; Shah et al., 1998; Savargaonkar et al., 2001; Regragui et al., 2003).

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. As seen in Table 1, the most frequent discrepancies occurred with nonglial neoplasms such as central and extraventricular neurocytoma, hemangioblastoma, atypical meningioma, lymphoma etc being reported at the time of intraoperative consultation as gliomas. In one instance, a high grade (grade III) astrocytoma was reported as medulloblastoma. Two minor discrepant diagnoses included one type of glial neoplasm being misinterpreted as another type of glial neoplasm e.g. ependymomas being incorrectly diagnosed as oligodendroglioma and pilocytic astrocytoma. Another common error was in diagnosing low grade glioma on FS, where permanent sections revealed reactive gliosis only. This particular discrepancy may be due to sample error (very small sample) and may be unavoidable because many gliomas are morphologically heterogeneous and error may result due to a very small sample. A large majority of our discrepant cases belonged to the same categories as reported in the Western literature (Plesec et al., 2007).

Some centers and studies propagate cytology preparations together with FS for intraoperative diagnosis of CNS lesions (Brainard et al., 1997; Roessler et al., 2002), while others propagate FS only (Reyes et al., 1991; Robbins et al., 1994). Those propagating the former point to the soft and edematous nature of neurosurgical specimens which makes it easier to prepare smears, and which result in FS being suboptimal with freezing artifacts. They also point to the fact that preparing smears is simple and quick and may provide improved cellular details (Plesec et al., 2007). The proponents of FS argue that diagnostic accuracy is increased due to preserved tissue architecture and a similarity to permanent sections

(Roessler et al., 2002; Plesec et al., 2007). However, several studies have noted that both compliment each other and should be used together to obtain the best results (Savargaonkar et al., 2001; Plesec et al., 2007) and this has been our observation as well. We routinely look at cytology smears and FS whenever a case of a CNS lesion comes for intraoperative consultation.

A case of diffuse large B cell lymphoma (DLBCL) was misreported as a glioma. Plesec et al (2007) have also noted this difficulty which sometimes arises in FS due to presence of large number of reactive astrocytes in the background. One of the discrepant cases in our series was reported as meningioma. It turned out to be a schwannoma on permanent section. Again, distinguishing between these two tumour types can sometimes be difficult on FS. Plesec et al have noted that this distinction is sometimes difficult because both these types of neoplasms commonly arise at the cerebellopontine (CP) angle, and have a spindled cell appearance. If submitted tissue is limited or if it is distorted by crush artifact or cautery, this distinction sometimes becomes difficult.

Two of our discrepant cases were central neurocytoma and one was extrventricular neurocytoma, which were misdiagnosed on FS. In future, we need to be more aware of central neurocytoma especially in intraventricular lesions. One case in our series was deferred. FS diagnosis was atypical cells, deferred until permanent sections. The final diagnosis in this case was DLBCL.

One problem that we often face is lack of adequate communication with neurosurgeons especially in cases which are received from other hospitals. The importance of such communication cannot be overemphasized (Powell 2005) and in our setting needs to be improved.

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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