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آموزش مهارت های کاربردی در تدوین و چاپ مقاله
The Value of Touch Preparation for Rapid Diagnosis of Brain Tumors as an Intraoperative Consultation

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Abstract

Background: The touch preparation technique is an accurate and rapid method, and when used as intraoperative consultation examination technique it preserves a good amount of tissue for paraffin embedded sections. This study aimed at examining the accuracy of the touch preparation technique by comparing its diagnosis with that of final pathological diagnosis made by microscopic examinations.

Methods: The diagnoses of 139 central nervous system lesions by touch preparation technique and paraffin-embedded sections were compared.

Results: Touch preparation technique diagnosed correctly 118 (84%) of the lesions. However, the technique failed to correctly diagnose 12% of the cases. The highest rate of accurate diagnosis (100%) was observed in five types out of 11 types of tumor examined. However, the technique was not able to diagnose hydatid cysts correctly.

Conclusion: The findings indicate that touch preparation technique may be useful in diagnosing tumor type during surgical operations. Touch preparation technique is very accurate for intraoperative diagnosis. However, adequate clinical history, neuroimaging details, and the intraoperative impressions of the neurosurgeons, if provided, help the pathologists to improve the diagnostic accuracy of the technique.

Keywords: • Intraoperative • Central nervous system • Frozen sections

Introduction

Tissue specimens taken from patients during operations or biopsies are usually assessed by the pathologists one or two days after the surgery. However, sometimes pathological results are needed urgently during the operation, while the patient is still on the operation table. In neurosurgical operations the need of a rapid diagnosis during the operation can be met by intraoperative consultation examinations. During surgeries, surgeons want to particularly know whether or not a lesion is malignant. The use of touch preparation technique, known as touch preparation as an intraoperative consultation examination technique is now well established. A good intraoperative consultation examination technique should preserve good amount of tissue for paraffin embedded sections, and should be accurate and rapid. Frozen section is another intraoperative consultation examination
The architecture of tissues in frozen section closely approximates permanent histology sections, and enables a degree of comfort. Touch preparation provides a better and crisp cellular details and even some tissue architecture. Touch preparation has been found quite reliable and useful in the determination of surgical resection margins, sentinel lymph nodes, adenomatous goiter, and confirmation of parathyroid tissue. This technique has some advantages in diagnosing and differentiating brain tumors.

Various diagnoses can be well made by an expert pathologist using touch preparation technique, because the cytomorphological features of smears in every malignant or benign lesion are specific. The objective of the present study was to evaluate four years (2007-2011) of using touch preparation technique by Shahid Beheshti Hospital pathologists to examine benefits and possible defects of the technique in determining the diagnosis of central nervous system biopsies taken during operations. The accuracy of the technique was judged against the diagnosis made by final pathological diagnosis.

Materials and Methods

This study aimed at assessing the value of diagnosis made by touch preparation technique in 2007-2011. All of the patients signed the written informed consent to include their data in the study. The study was approved by the Ethics Committee, Kashan University of Medical Sciences. Biopsies taken from lesions were grossly examined, and hemorrhagic and necrotic areas were sampled and prepared for the touch preparation technique. At least two smears were taken from each case by using two clean grease-free glass slides. The smears were fixed with absolute alcohol and were stained with geimsa and papanicolau. After the surgeries, remaining tissues were processed for paraffin-embedded sections, haematoxylin and eosin staining, and microscopic examination.

The microscopic examination of paraffin sections, and touch preparation were made blindly by two pathologists. To examine the accuracy of diagnosis by touch preparation technique, the diagnoses obtained by this technique were compared with those obtained by microscopic examination of the smears. Accurate grading was attempted in our study whenever possible. All the cases were reviewed by two pathologists separately. All the patients personal information remained private.

The findings were analyzed using Statistical Package for Social Sciences (SPSS version 16). Descriptive statistics was used to analyze the findings.

Results

During the study, 139 lesions, which had been sent for intraoperative consultation, were evaluated. These included 135 brain lesions and 2 hydatid cysts, and 2 dermoid cysts. The average patients’ age was 57, and there were 70 males and 69 females. The total number tumor and correct diagnosis in touch preparation technique. Correct diagnosis was made in 118 (84%) of lesions. Errors in diagnosis were seen in 12% of lesions. The highest correlation (100%) was observed in five types of tumor, and no correct diagnosis was made in case of hydatid cyst. Oligodendrogliomas, haemangioblastoma, meningioma, choroid plexus papilloma, craniopharyngioma, megakaryocytic leukemia, and dermoid cyst were diagnosed totally (100%) correct (table 1).

| Tumors                            | Total cases | Correct diagnosis (%) |
|-----------------------------------|-------------|-----------------------|
| Oligodendroglioma grade II–III    | 6           | 6 (100)               |
| Meningioma                        | 15          | 15 (100)              |
| Pituitary adenoma                 | 13          | 11 (84)               |
| Haemangioblastoma                 | 3           | 3 (100)               |
| Astrocytomas grade I              | 22          | 18 (81)               |
| Astrocytomas grade II, III, IV    | 26          | 21 (80)               |
| Glioblastoma multiforme           | 6           | 4 (66)                |
| Metastatic carcinoma              | 9           | 6 (66)                |
| Medulloblastoma                   | 9           | 8 (88)                |
| Choroid plexus papilloma          | 1           | 1 (100)               |
| Schwannoma                        | 11          | 10 (90)               |
| Hydatid cyst                      | 2           | 0 (0)                 |
| Craniohypophygioma                | 3           | 3 (100)               |
| Inflammation and necrosis         | 4           | 4 (100)               |
| Giant cell tumor                  | 5           | 4 (80)                |
| Dermoid cyst                      | 2           | 2 (100)               |
| Megakaryocytic leukemia           | 2           | 2 (100)               |
| Total cases                       | 139         | 118 (84)              |
The accuracy of touch preparation technique for astrocytoma, pituitary adenoma, glioblastoma multiforme, metastatic carcinoma, and giant cell tumor was 81%, 84%, 66%, 66%, 88% and 80%, respectively.

Glioblastoma multiforme was misdiagnosed twice as metastatic carcinomas, and high grade astrocytoma was misdiagnosed five times as metastatic carcinomas. Two cases of astrocytoma grade I was misdiagnosed as metastatic carcinomas, and one case of medulloblastoma was misdiagnosed as meningioma. Other misdiagnosed tumors were reported as benign or malignant microscopic results or inflammation (figure 1-6).

Figure 1: Low grade astrocytoma: mild nuclear pleomorphism, mild to moderate hyperchromasia, absence of mitotic activity and dyscohesive pattern, minimal derivatium in nuclear shapes. Left: permanent pathologic slide (hematoxyline eosin x10). Right: touch preparation (Geimsa ×40).

Figure 2: Glioblastoma multiforme. Left: permanent pathologic slide (hematoxylin eosin x10), anaplastic and pleomorphic cells without glial processes and endothelial hyperplasia. Right: touch preparation (papanicolau x40), pleomorphic cells and atypical nuclei.

Figure 3: Meningioma: meningothelial cell proliferation with whorl formation. Left: permanent pathologic slide (hematoxylin eosin x40), indicators show whorl formation. Right: touch preparation (papanicolau x400), the indicator shows the whorl formation.
Discussion

The present study was a retrospective analysis to determine the accuracy of touch preparation technique in diagnosing the type of tumors encountered during the operation. This technique is reliable, simple, and accurate. Different authors used various stains such as 1% alcoholic toluidine blue and May-Grunwald–Giemsa.3,4 We, however, used Giemsa and papanicolaou.

Compared to frozen section, in touch preparation technique and a large area of tissue can be examined. Besides, touch preparation technique provides enough tissue for intraoperative and
Value of touch preparation for diagnosis of brain tumors

The diagnostic accuracy of touch preparation technique ranges from 75% to 94%. In the present study, the accuracy of touch preparation technique in diagnosing brain lesions was 84%, which is lower than that of other studies that included tumors only. This may be due to the inclusion of other types of tumor such as bone tumors in the study of neurosurgical tumors. The low diagnostic accuracy of touch preparation technique in our study may be related to limited sample size.

The diagnostic accuracy of touch preparation technique for high and low grade astrocytoma was 81% (39 out of 48) in our study. Correct diagnosis rests on appropriate radiological and intraoperative impressions. When a small biopsy was submitted and typical features of pilocytic astrocytoma were not present, it was difficult to correctly diagnose, or to grade the tumor. Moreover, when vascular proliferation and atypia were interpreted without adequate clinical history, a misdiagnosis of high grade astrocytoma was made. When cellular pleomorphism, giant cells, mitoses necrosis and vascular proliferation were present, the diagnosis of glioblastoma was obvious (figure 1). Because of high cellularity, pleomorphism and the round to polygonal appearance of the cells, high grade astrocytomas and glioblastomas are often confused with metastatic carcinoma. Glioblastoma multiforme is the most undifferentiated type of astrocytoma. Anaplastic and pleomorphic cells that have no glial process are the key point in the diagnosis glioblastoma multiforme. is another diagnostic clue. (figure 2).

Meningothelial, transitional and psammomatous meningiomas (three types of meningiomas) usually present no diagnostic difficulty because they exhibit features of non-neoplastic arachnoid cap cells, particularly the tendency to form whorls. (figure 3). The nuclei of many meningiomas (especially the meningotheial types) show two types of intranuclear vacuoles. One type is formed by invagination of cytoplasm into the nucleus and the other by clearing of chromatin material from the center of the nucleus. The latter type is more common and is of diagnostic help.

Distinction between schwannomas and meningiomas was the commonest difficulty. Especially the fibroblastic meningiomas were confused with schwannoma as they lack whorls. In addition to whorls, the presence of intranuclear inclusions and calcification is of help in diagnosing meningiomas. Chordoid meningiomas were misinterpreted as chordoma and atypical meningioma with metastatic carcinoma. In haemangioblastomas, obtaining good quality smears was difficult. This made the identification of numerous blood vessels difficult. However, all of the cases of meningiomas and 10 out of 11 cases of schwannoma were diagnosed correctly, because of the mentioned diagnostic characteristics (figure 3 and 6).

The accuracy of the touch preparation technique for pituitary adenomas was 84%. The cellular monomorphism and the absence of a significant reticulin network distinguish pituitary adenomas from non-neoplastic anterior pituitary parenchyma (figure 4). These characteristics made the diagnosis of this type of tumor easy. Eleven of 13 cases were diagnosed correctly, but two cases were not diagnosed correctly using

| Authors              | Year | Lesions          | Diagnostic accuracy |
|----------------------|------|------------------|---------------------|
| Adams et al.16       | 1981 | Tumors           | 93.6%               |
| Asha et al.17        | 1989 | Tumors+Infection | 87%                 |
| Shah et al.19        | 1992 | Tumors           | 96%                 |
| Chako19              | 1998 | Tumors+Infection | 88%                 |
| Bleggi-Torres et al.20| 2001 | Tumors           | 97.3%               |
| Roessler et al.21    | 2002 | Tumors+Infection | 95%                 |
| Goel et al.22        | 2007 | Tumors+Infection | 86%                 |
| Present study        | 2011 | Tumors+Infection | 84%                 |
touch preparation technique.

In haemangioblastomas, obtaining good quality smears was difficult. This made the identification of numerous blood vessels difficult. The smears showed thick and dense trabeculae of elongated cells, which led to misinterpretation. The clinical history of posterior fossa location is mandatory for correct diagnosis. Haemangioblastoma had numerous mast cells 10, which helped in its diagnosis. All such characteristics helped correct diagnosing of all three cases of haemangioblastomas in our study.

Hydatid cysts are endemic in Kashan, Iran. Two cases of hydatid cysts were among the cases in the present study. Hydatid cysts are diagnosed by the presence of scolex and a cyst with a laminated layer (figure 5). Touch preparation technique could not the two cases of hydatid cyst in our study.

**Conclusion**

Touch preparation technique is a rapid diagnostic method and a good complimentary technique for frozen section. Inadequate clinical and imaging data can contribute to wrong diagnosis. The experience of a pathologist is very important as diagnosis is made on cytology alone without any special stains and in a short time. Awareness of the cytomorphological features on smears of various lesions is important. In 64% of cases correct diagnosis could be made on smears alone, and in another 20% after clinical and radiological correlation.

Touch preparation technique is a very accurate and rapid method of intraoperative diagnosis, especially when combined with frozen section. However, adequate clinical history, neuroimaging details, and the intraoperative impression of the neurosurgeon, if provided, helps the neuropathologists to improve the diagnostic accuracy.

**Conflict of Interest:** None declared.

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