

## Original Articles

# ACCURACY OF INTRAOPERATIVE FROZEN SECTION DIAGNOSIS AND TOUCH IMPRINT CYTOLOGY: STUDY ON 1000 CONSECUTIVE CASES

S.Z. TABELI, M.D.,\* AND M. HOSSEINZADEH, M.D.\*\*

*From the Department of Pathology,  
Shiraz University of Medical Sciences, Shiraz, I.R. Iran.*

### ABSTRACT

Frozen section and touch imprint cytology are important diagnostic procedures for surgeons during operation and must be accurate if the patient is to receive maximum benefit.

To assess the accuracy of intraoperative pathologic consultation including frozen section and touch imprint cytology during a five year period (1995-2000), a retrospective survey of 1000 consecutive cases of frozen sections performed by the staff pathologists of Shiraz Medical School and 211 touch imprint cytology cases related to some of these sections were studied focusing on accuracy.

Also some 462 cases of frozen sections related to the 1000 samples were reviewed by the staff pathologists without complete clinical data and without any data from the surgeon to determine the importance of the surgeon pathologist relationship.

The gold standard method for comparing the results of frozen section and cytology was permanent tissue diagnosis.

The overall accuracy of frozen section for the 1000 cases was 93.6%. The accuracy of cytology was 93.1%. Also the accuracy of 462 frozen sections which were reviewed without clinical data was 85%.

In conclusion, frozen section diagnosis is a highly accurate method. Touch imprint cytology is also a specific method and can be used in areas where facilities of frozen section studies are not available.

The frozen section method achieves its highest accuracy when there is cooperation between the surgeon and pathologist and when used in combination with touch imprint cytology.

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### INTRODUCTION

Intraoperative pathologic consultation including macroscopic examination of the tissues, touch imprint cytology and frozen section is the most important procedure

\*Professor of Pathology, Shiraz University of Medical Sciences.

\*\*Assistant Professor of Pathology, Fasa Medical School.

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to help intraoperative therapeutic decision making.

The principle use of the method is for diagnosing the malignant or benign nature of suspected tumors. Other uses include determination of adequate excision of tissue, confirming suspected metastasis, identifying small structures and evaluating surgical margins.

The usefulness of frozen section diagnosis for a surgeon greatly depends upon the reliability and accuracy of the information that he receives from the pathologist. The low accuracy of the method may lead the surgeon to inappropriate decision-making. Therefore a false positive diagnosis of a cancer may lead to unnecessary radical surgery, e.g. radical mastectomy or even amputation of a limb. On the other hand, false negative diagnosis leads to inadequate surgical management, and these errors are dangerous in the patient's outcome.

### MATERIAL AND METHODS

A retrospective survey of 1000 consecutive cases of frozen section diagnosis, focusing on accuracy of the method was performed by the staff pathologists of Shiraz Medical School from 1995 to 2000 by comparison with final permanent diagnosis. Although all ten staff pathologists were involved in this study, each case was not seen by all of them. Instead, as routine frozen section was performed daily at the ward, the case was randomly studied by one of them.

Some 462 cases were studied again outside the operating room, without any previous clinical data. Their results were then compared with the diagnoses made in the operating room to determine the importance of clinical data and the surgeon pathologist relationship for an accurate result.

Also 211 cases of touch imprint cytology related to the 1000 cases were studied to determine the accuracy of cytology.

Material for frozen section was received from the operating room and was examined immediately by the pathologist. He performed touch imprints from the sus-

pected areas of fresh specimens in 211 cases and stained it by Hematoxylin-Eosin method. The material was then frozen by the use of a cryostat at -25 degrees centigrade, and embedded in ethylene glycol based media (OCT). It was then sectioned and stained by H&E method.

The final pathologic diagnosis from paraffin blocks was recorded separately and at the end of the study was compared with the results of frozen sections and cytology.

The discrepancies between diagnosis by cytology and frozen section were compared with the final tissue diagnosis and apparent errors were divided into three categories:

- A) false positive (benign tumors called malignant)
- B) false negative (malignant tumors called benign)
- C) nonconclusive

The following major anatomic categories were used in this study:

CNS, Breast, Lymph Node, Gastrointestinal Tract, Soft Tissue, Bone and Miscellaneous organs.

Following this categorization errors in each organ system were studied separately.

### RESULTS

The anatomic origin of the frozen section specimen and the results are given in Table I.

The total accuracy of frozen section in 1000 cases was 93.6%. In the remaining 6.4%, 21 cases (2.1%) were false positive and 42 cases (4.2%) were false negative. The accuracy of frozen section in soft tissue and bone lesions was 65.4% and 88.9% respectively which was lower than other organ systems.

Because most of our cases were from the CNS, breast and lymph nodes (67% of cases) and our staff pathologists are possibly more experienced in those organ systems, the accuracy in such cases was relatively higher than other organs.

Table II shows the accuracy of touch imprint cytology. Most of the cases were CNS tumors with high accu-

**Table I.** Results of 1000 consecutive frozen sections.

Organ	Total cases	False positive	False negative	Total errors	Accuracy	Inconclusive
CNS	483	8	12	4.2%	95.8%	5
GI	123	3	8	9%	91%	1
Breast	109	1	6	6.4%	93.6%	1
LN	77	1	3	5.3%	94.7%	2
Bone	30	-	3	11.1%	88.9%	3
Soft t.	26	3	6	34.6%	65.4%	-
Other	152	5	4	6.2%	93.8%	9
Total	1000	21	42	6.4%	93.6%	21

**Table II.** Results of touch imprint cytology in 211 cases.

Organ	Total cases	False positive	False negative	Total errors	Accuracy	Inconclusive
CNS	91	3	1	5%	95%	12
LN	30	1	3	14%	86%	2
Breast	29	-	-	0%	100%	1
GI	23	2	-	9.5%	90.5%	2
Others	38	2	1	9.3%	90.7%	6
Total	211	8	5	6.9%	93.15	23

**Table III.** Results of 462 frozen sections related to the 1000 cases performed without clinical data.

Organ	Total cases	False positive	False negative	Total errors	Accuracy	Inconclusive
CNS	201	8	8	11%	89%	25
Breast	65	3	4	7.9%	92%	10
GI	53	6	5	22%	78%	3
LN	37	5	6	37%	63%	8
Others	106	7	9	17%	83%	12
Total	462	29	32	15%	85%	58

racy. The lymph node cytological study is overall more difficult for interpretation and as shown had a relatively lower accuracy.

All of the cases of breast cytology were diagnosed correctly.

Table III shows the accuracy of 462 cases of frozen sections performed in a special situation (without clinical data and outside the operating room without any relationship with the surgeon).

Table IV shows the accuracy of 462 cases of frozen section which was performed in the operating room with complete clinical and radiological data and operative findings.

By comparing Table III and IV the difference between the accuracy of frozen section with and without clinical data is statistically significant ( $p < 0.05\%$ ).

## DISCUSSION

The frozen section technique was first performed by Welch on a benign breast lesion removed by Halsted in 1891. The real development of the method, however, was mainly the work of MacCarty at the Mayo Clinic, beginning in 1905.<sup>12</sup>

A number of studies from 1929 to date comparing the accuracy of frozen section diagnosis indicate that the error rate averages about 1% to 6%, but others have found

an error rate up to 11%.<sup>2,10,11</sup> In 1927 Dudgeon and Patrick introduced touch imprint cytology for examination of tumors and inflammatory tissues.<sup>14</sup> In 1969 Sakai showed that the accuracy of cytologic examination was 95.5% and that of frozen section 95.7%, almost identical.<sup>12</sup>

This study represents quality assurance in a series of 1000 consecutive cases of frozen sections and 211 touch imprint cytologies performed at Shiraz Medical School during a five year period (1995-200).

The overall accuracy of frozen section was 93.6%. The accuracy of touch imprint cytology was 93.1%. Compared to frozen section, touch imprint cytology is a very simple and low cost method for intraoperative pathologic consultation, however it requires experience in cytopathology for interpretation in order to have more accurate results. This method can be used in areas where facilities for frozen section are not easily available.<sup>14</sup>

The combination of the two methods is very important and necessary for an accurate diagnosis. On the other hand, an appropriate surgeon-pathologist relationship and responsibility acceptance is important for increasing the accuracy of the method.

The surgeon and pathologist must each accept certain responsibilities if the patient is to receive maximum benefit from the intraoperative pathologic consultation.

The surgeon must first understand the limitations of the method and must not ask for more information which

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**Table IV.** Results of the same 462 cases performed with complete clinical data.

Organ	Total cases	False positive	False negative	Total errors	Accuracy	Inconclusive
CNS	201	3	5	4.1%	95.9%	8
Breast	65	0	4	6.2%	93.8%	1
GI	53	0	5	9.4%	90.6%	0
LN	37	0	0	0%	100%	1
Others	106	3	1	3.9%	96.1%	5
Total	462	6	15	4.6%	95.4%	15

the method is not capable of giving, e.g. the proper determination of the grading of the tumor.

The surgeon must accept the pathologist's refusal to make a diagnosis in doubtful cases, he must also submit an adequate biopsy, representative of the lesion and if possible of sufficient size for both gross and microscopic examination. Finally he must supply the pathologist with all pertinent clinical information.

On the other hand the frozen section method is one of the most difficult procedures that the pathologist performs during his practice. It requires experience, knowledge of clinical medicine and pathology, the capacity to make a quick decision under pressure, good judgment and an attitude that is conservative but not excessively so and a keen awareness of the limitations of the method. Careful gross examination of the specimen is necessary both for selecting the proper area for sectioning and because gross examination has some influence on the final decision.

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