Role of Surgeons in Determining Outcome of Histopathology Specimens

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ABSTRACT

Background: In the changing world of clinicopathologic practice where surgeons and pathologists are faced with increasing therapeutic demands, precise demands of each group from the other have often been reduced to blames and counter-blames. This study is thus aimed at auditing the current practice of specimen handling as a means of highlighting areas where mutual best practice is required. **Materials and Methods:** A total of 200 specimens and 100 separate request cards received over the 3 months were audited for: Use of fixative, adequacy of fixative used, types of specimen containers and appropriate labeling of containers. The request cards were audited for: Documentation of patients' hospital numbers, ages, histories of disease, sites of biopsy, examination findings, investigations done, provisional diagnosis and concordance of clinical diagnosis with histopathological diagnosis. **Results:** About 20% of specimens were unfixed, 23.5% had inadequate fixative, 16.5% were in inappropriate containers and 32.5% were incompletely labeled respectively. In 25%, 50% and 53% of forms the age, clinical history and examination findings respectively were not documented. Provisional diagnosis was in concordance with eventual histological diagnosis in 69% of cases. **Conclusion:** To ensure the quality of histopathological diagnosis with minimal turnaround time, the surgeon plays a vital role by ensuring adequate and prompt fixation of tissue biopsies, put in the right container and accompanied by well labeled request cards.

KEYWORDS: Formalin, fixative, outcome, pathologist, surgeon

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INTRODUCTION

The traditionally recognized phases of laboratory work are the pre-analytic, analytic and post-analytic phases. Even though, all these phases are important in determining the quality and turnaround time (TAT) of tissue biopsies in histopathology, the pre-analytic phase is arguably the most important. The quality and quantity of biopsy taken by the surgeon determines the accuracy or otherwise of the report issued.[1] Both data- and anecdotal-based evidences abound regarding the impact of adequacy of biopsy on correctness of reports.[2,3] In addition to this, other tissue handling variables also come into consideration in determining factors that influence the final outcome of tissue biopsies. These include optimal fixation, properly filled request forms and correct specimen labeling among others.[4,5]

The consequences of inadequate handling of tissues for histopathology have included long TATs, unsatisfactory or inaccurate reports, inability of the pathologist to render a diagnosis and sometimes negative clinical implications for patients.[3,6] Patient may be subjected to unnecessary treatment with its attendant risk, wastage of resources, to repeated biopsies, avoidable mortality and morbidity as well as anxiety among the populace about the health-care delivery system as a whole.[6]

To prevent these avoidable outcomes the need thus arises to examine these pre-analytic variables. Without this being done the communication gap between surgeons and pathologists will not be bridged and the expectations of each from the other not met. This study therefore aims to audit the present practice of tissue handling by surgeons vis a vis conformation with minimum expectations by Pathologists with a view to improving performance.

MATERIALS AND METHODS

During one of the continuous medical education (CME) provided by Nigeria Medical Association in the state where the study was conducted, a lengthy seminar was organized by the principal author to educate surgeons and other clinicians on appropriate handling of pathology specimens. Participants included surgeons from all the areas covered by the pathology laboratory to which biopsies are sent.

At 2 weeks after the seminar while the information passed was still fresh, this study was commenced and ran for 3 months. A total

of 200 specimens from 60 batches of about 21 specimens per batch were selected at random, taking different surgical specialties and hospital of origin into consideration. The specimens were submitted from both the parent teaching hospital within which our pathology laboratory is located and from peripheral hospitals. These specimens were assessed for the following parameters: Submission in 10% formal saline, adequacy of the formalin (adjudged as totally covering the specimen and of minimum of formalin to tissue ratio of 2:1), adequacy of the container (large enough to hold specimen and with wide mouth and tight fitting lid) and adequacy of container labeling (to include name, hospital number, ward/hospital and site of biopsy). To increase the spread, 100 randomly selected request cards from other specimens not included in the study were also assessed for documentation of patient's hospital number, age, any relevant history of disease, site of biopsy, any examination finding, any investigation done and provisional clinical diagnosis. Where the provisional diagnosis was provided this was assessed for concordance with final histopathological diagnosis. Performance of surgeons from within the teaching hospital was compared with those from outside and the data generated managed with statistical packages. Chi-square (χ^2) and P values were calculated at 95% confidence interval.

RESULTS

The 200 specimens were randomly selected from 60 batches of 1250 specimens received over the 3 months period after the CME presentation. Eighty seven (43.5%) were received from surgical departments within the teaching hospital while the remaining 113 (56.5%) specimens were from other hospitals.

As shown in Table 1, one out of every 5 (20%) specimens was not fixed at all in formalin, with 14.9% of specimens emanating

from within being unfixed and as much as 23.9% of specimens from outside meeting the same fate. Another 47 of 200 (23.5%) specimens were fixed in formalin, but with inadequate quantities. In this respect, the surgeons from the teaching hospital statistically performed better than those from outside (14.9% vs. 30.1%; $\chi^2 = 6.272$, $P = 0.012$). Table 1 also shows that 16.5% (33/200) specimens were put in inappropriate containers and the containers were inadequately labeled in 32.5% (65/200) of specimens. Again the teaching hospital surgeons performed statistically better than surgeons from outside ($\chi^2 = 4.908$, $P = 0.027$). Only one specimen (0.005%) met all the requirements.

Table 2 shows results of the 100 request cards evaluated. Of these, 38 were filled by medical staff from our center and the remaining 62 cards from outside. Statistically significant better performance from our surgeons was in respect of documentation of patients' hospital numbers on request cards ($P < 0.0001$). Age of patient, clinical history and site of biopsy were documented in 75%, 50% and 47% respectively. Investigations already done (18%) and examination findings (25%) were the least documented by both groups. Provisional diagnosis was documented in 84 of 100 cards and 69% (58/84) of which were concordant with final histopathological diagnoses. In only three (3%) forms were all required information documented.

DISCUSSION

Around 10% formal saline (or neutral buffered formalin) is an all-purpose fixative[7] and even though it is cheap and readily available, yet as much as 1 in 5 of our received specimens was unfixed. This is higher than the frequency of about 1% recorded for specimens received for a study[8] on an organ-specific lesion. Similarly, only about 1.2% of ocular tissues submitted

Table 1: The performance of surgeons within the teaching hospital and those outside in proper handling of pathology specimens

Specimen and container characteristics	Number documented	%	Number (from within the hospital)	%	Number (from referral hospitals)	%	P value (at 95% CI)
No fixative	40/200	20.0	13/87	14.9	27/113	23.9	0.117
Inadequacy of fixative	47/200	23.5	13/87	14.9	34/113	30.1	0.012
Inappropriate container	33/200	16.5	14/87	16.1	19/113	16.8	0.892
Inadequately labeled container	65/200	32.5	21/87	24.1	44/113	38.9	0.027

CI: Confidence interval

Table 2: The request card filling practice of personnel from within the teaching hospital and those from outside

Parameters to be documented in the request cards	Number documented	Number documented by surgeons within	Number documented by surgeons from outside	Comparison of performance (P value)
Patient case number	61/100	36/38	25/62	<0.0001
Age	75/100	29/38	46/62	0.812
History of disease	50/100	21/38	29/62	0.4099
Site of biopsy	47/100	21/38	26/62	0.1949
Examination findings	25/100	11/38	14/62	0.4754
Investigations done	18/100	11/38	7/62	0.0257
Working diagnosis	84/100	31/38	53/62	0.6051
Concordance of clinical diagnosis with histology	58/84	19/31	39/53	0.2395

for histology in a Karachi study[9] were reported as unfixed. The states in which our specimens were received varied from complete absence of fixative to use of normal saline and occasionally chlorhexidine (savlon) solution and kerosene. These unfixed specimens are unsuitable for special stains such as immunohistochemistry (IHC) as targeted antigens (proteins) would have been lost.[10] No reports can be rendered by the pathologist from such autolysed specimens.

Volume of fixative used was inadequate in approximately 1 in 4 (23.5%) of the submitted specimens. This is lower than the 35.2% reported by Muhammad *et al.*,[11] in Pakistan. While fixative to tissue ratio of 10:1 is recommended,[12] this may not be very feasible for large specimens. To this end Buesa and Peshkov have shown that a minimum ratio of 2:1 is still acceptable.[13] The tissue must however, be fully submerged in the fixative solution. The need for an excess of the fixative is to ensure that when equilibration occurs with tissue fluid the concentration of the fixative does not drop beyond useful levels. The statistically significant better performance ($P = 0.012$) of our in-house surgeons in this respect is a reflection of greater availability of prepared formalin in our hospital and at no cost to the surgical departments. From the foregoing, the onus, thus, is on surgeons practicing in private, primary and secondary health-care facilities to devise means of getting the correct fixatives in the right amounts.

Even though from the foregoing, it can be inferred that formalin fixation is crucial, promptness of fixation is no less very essential. With the exception of tissues destined for special studies, such as enzyme studies where fixation is undesirable, tissues should be immediately submerged in the fixative. This shortens the "warm ischemia time," which is described as the time from ligation of vessels supplying an organ or excision from its anatomical site in the patient to commencement of fixation.[14] This time has been shown to have an impact on the outcome of diagnostic tests such as ribonucleic acid analysis or IHC.[12]

Furthermore, the interplay of tissue volume (relative to formalin), tissue thickness and duration (before and during fixation) are important in determining final pathology report.[15] A small number of our specimens were over-fixed in concentrated formalin. This results in alteration in tissue morphology and difficulty in retrieving certain antigens such as estrogen receptor and epidermal growth factor receptor during IHC. Large specimens on the other hand may be under-fixed because the rate of formalin penetration is about 1 mm/h.[16] Thus the outer part of the specimen may be well-fixed while the core is under-fixed. Such specimens need to be promptly transected (preferably by the Pathologist who also has to take cognizance of the contents of cystic specimens) to ensure uniform fixation. The standard duration of fixation is also affected by tissue size. It usually ranges from 5 h for small tru-cut and endoscopic biopsies to < 48 h for larger specimens, including those for IHC.[10,12] Tubular organs should also be tagged with respect to their proximal and distal ends and lymph nodes identified by their known regional grouping.[17]

Similar to findings in the study from Pakistan[11] that a modest number of specimens (29%) were put in inappropriate containers, 16.5% of our specimens were in such containers. These included injection bottles, cut infusion bottles and baby feeding bottles among others [Figure 1]. Although narrow-mouthed specimen bottles may be suitable for needle, mucosal and skin biopsies, these are unsuitable for larger specimens as these specimens harden on fixation and become difficult to remove from such containers. These inappropriate containers also deform the specimens and prevent formalin from getting even access to all parts of the tissue. Not only do cut infusion bottles prevent achievement of optimum tissue to formalin ratio they also predispose to formalin and or tissue loss. The ideal container allows for achievement of optimum tissue: Formalin ratio, allows for complete submergence of tissues, does not contort tissues and has a wide mouth.[18]

Other quality control-related issues involved labeling of specimen containers. Although at the minimum patient name, hospital number, ward/hospital of origin and type of specimen are expected to be documented on the containers, in different combinations these were absent in about 1 in every 3 (32.5%) of our specimens compared with 4.3% reported by Muhammad *et al.*,[11] in Pakistan and 9.6% documented by Nakhleh and Zarbo[19] in their study of over a million cases in the United States (US). Statistically significant difference in performance between in-house surgeons and those from outside our reference center may also be due to the fact that usually house officers rather than nurses or technicians label these containers in our center unlike what obtains outside.

While the temptation may be great to consider the request card as relatively inconsequential, it is in fact a key factor in tissue processing. It serves not only as a communication between professional peers, but also as a letter of contract, stating what the client (the surgeon) requires from the service provider (the Pathologist). Thus, the expectation that it should be carefully

Figure 1: The predominant types of specimen containers in which specimens were sent, left shows a cut off infusion bottle with half of the specimen unfixed; middle, an anesthetic bottle; and right a baby feeding-bottle

filled is justified. Who then fills the form and what information is deemed essential? These are often issues that have no definite answers, rather these are issues best settled with communication between Pathologists and surgeons.

In tertiary hospital settings, house officers have been traditionally encumbered with the responsibility of filling request cards. Unfortunately, this has been associated with important omissions because more often than not the officer is usually not fully cognizant of the patient's condition. From the foregoing, it therefore means that the crucial factor in form filling is possession of adequate information about the patient. In the light of this, the most appropriate person to fill these forms would therefore be the most knowledgeable about the patient's condition.

Most of the Pathologists' checklist would include age of the patient; significant history of the disease including duration; site of biopsy, provisional diagnosis and result of relevant investigations done.[20] Though the in-house surgeons were more consistent with documentation of patients' hospital numbers on request cards than surgeons from outside, this kind of omission reflects the practice of poor record keeping in private practice. Omission of age in 25% of our cases is higher than the 5.8% documented by Muhammad et al.,[11] omission of the site of biopsy in 53% cases was also higher than their 13%. While the study[19] of request card filling practice in 417 hospitals in the US reported omission of clinical history in only 2.4% of their request cards, this omission occurred in 50% of ours, even though not all required obtaining additional clinical information before diagnosis could be reached.

Additional clinical information had to be requested from our surgeons in 6% (3 of 50) cases. This is higher than the 0.08-3.01% reported by Nakhleh et al.,[21] in another study. The need for additional information increased our TAT of 5.6 days (86.7% completion rate within 5 working days) to an average of 5 days for these cases. This is higher than the additional 1 day or less (in 16.2% cases) such inadequate information added to the TAT reported in the US study.[21] Our higher rate may reflect the fact that 56.5% of our specimens originate from outside our parent hospital and thus communication with the surgeons is difficult, often requiring us to wait until when the reports are sought. Even though, this may be associated with additional costs, inclusion of surgeons' phone numbers on request cards is the panacea being explored.

In a bid, honestly, not to bias the pathologist's mind provisional diagnosis is sometimes not documented on request cards. Yet, for the pathologist, insistence on documentation of provisional diagnosis on request cards is more of an instrument for him to peep into the surgeon's mind; to know what he, who saw the patient, is thinking and to know if he (the pathologist) is answering the clinical questions agitating the surgeon's mind regarding the patient's presentation. In the light of this, only 69% of diagnoses stated on request forms were in concordance with

final histopathological diagnosis. Other studies from countries with demographics similar to ours have shown a concordance rate for different clinico-pathologic correlations ranging from 58.6% to 80%.[22,23] The quality of our diagnoses is enhanced mostly by the practice of ensuring consultant pathologists are involved with the sign-out process and as recommended by Association of Directors of Anatomic and Surgical Pathology, getting second opinions on difficult cases as the cases arise as well as periodically auditing archived cases.[24]

CONCLUSION

To ensure the quality of histopathological diagnoses with minimal TAT, the surgeon plays a vital role by taking representative biopsy, ensuring adequate and prompt fixation of the biopsy, put in the right container and accompanied by well labeled request cards.

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