Assessing the Usefulness of Salivary Gland Fine Needle Aspiration Cytology as Diagnostic Aid for Salivary gland Malignancy

Sir,

The main goal of any fine needle aspiration cytopathologic (FNAC) exercise is to rule out malignancy and formulate future course of actions. The diagnostic accuracy of FNAC to identify salivary gland (SG) malignancy (SGM) as compared to gold standard histopathology has been debated in systematic review and meta-analysis. In this regard we assessed the probabilistic performance validity of FNAC for SGM and would like to share the interesting results for wider clinical translation.

The uncertainties of diagnostic tests can be explained by the parameters such as sensitivity (Sn), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV), likelihood ratio of a positive and negative tests (LR +ve, LR –ve). Prior to performing FNAC, the dentist is expected to estimate the likelihood of a possible SGM “pretest probability (P)”. After the FNAC, new additional information is contributed to the likelihood of original working diagnosis, called “post-test probability (P’)”. Bayes theorem provides an excellent aid for this probabilistic approach. 

To study the accuracy of FNAC for diagnosing SGM, we analyzed collated data from a previous published, exhaustive, systematic review that had employed an extensive search, stringent inclusion and exclusion criteria for this purpose. The collated details of Collela et al., were obtained. The diagnostic tests were calculated using formulæ. The PPV and NPV also were identified as a function of Sn, Sp and the P by using the formulæ. 

\[
\text{PPV} = \frac{Sn \times p}{Sn \times p + (1 - Sp)(1 - P)}
\]

\[
\text{NPV} = \frac{Sp \times (1 - P)}{Sp \times (1 - P) + (1 - Sn) \times P}
\]

The PPV and NPV as a function of P (in increasing order) were then tabulated by increasing the P in the formula. The pre-test odds and post-test odds were calculated as given by the Bayes Theorem using P. From this, P’ was calculated.

Of the 1913 cases considered, FNAC accurately identified SGM in 387 (20.23%) instances and missed in 97 (5.07%) instances. FNAC also identified non-SGM in 1,401 (73.23%) instances and over-diagnosed in 28 (1.46%) instances. The Sn and Sp were calculated as 0.8 and 0.98 respectively. LR +ve was calculated as 40 and LR –ve was calculated as 0.2.

The reported global annual incidence of SGM is 2.6/100,000 (or 0.000026) populations. With this prevalence and using collated data from Collela et al., studies the PPV and NPV were derived as 0.1% and 100%. PPV reflects proportion of patients with SGM who were correctly diagnosed while high NPV indicate that a proportion of patients with negative result who were correctly diagnosed. The low prevalence of SGM, the degree of accuracy, trainings of cytopathologist, staining clarity, FNAC procedural accuracy and necrotic element could have contributed to these results.

When the P was increased to 50%, PPV% and NPV% was 97.6% and 83.0% respectively. Like all other diagnostic tests, with increasing pre-test probability the reliability of FNAC also increased. We increased the P up to 20%, identified the PPV%, NPV%, P [Figure 1 and Table 1] and then applied the Bayes theorem to identify the post test odds. From this P’ was
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| Table 1: Calculating post-test result (positive and negative) from pretest probability |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Pretest probability | Pretest odds | Post-test positive result | Post-test negative result |
|                   |               | Odds | Probability | Odds | Probability |
| 1                  | 0.01          | 0.41 | 0.29        | 0.002 | 0.002       |
| 3                  | 0.03          | 1.26 | 0.56        | 0.006 | 0.006       |
| 5                  | 0.05          | 2.15 | 0.68        | 0.011 | 0.01        |
| 10                 | 0.11          | 4.53 | 0.82        | 0.022 | 0.02        |
| 20                 | 0.25          | 10.2 | 0.91        | 0.05  | 0.048       |
| 50                 | 1             | 40.8 | 0.97        | 0.2   | 0.167       |

Figure 1: Positive predictive value, negative predictive value and post test probability as a function of pretest probability

Absence of the disease at a higher odds, the high NPV% makes FNAC an excellent tool to rule in the disease. However due to a comparatively low PPV, chance of missing malignancy remains high, a trend discussed in literature. Understanding the mathematics behind the FNAC testing allows the clinicians effectively, as well as critically appraise the utility of salivary FNAC in clinical practice.

It has been reported that the overall SG FNAC’s performance variability is too wide to formulate general guidelines regarding its usefulness for SGM. In addition to many factors, the diagnostic performance occupies an important role. Heterogeneity of accuracy, bias and random variations appear to influence SG FNAC outcome. Our study could not provide reliable evidence for FNAC as a main diagnostic modality for SGM. However, it may be rendered useful when coupled with advanced technique such as ultrasound guided FNACs and immunocytochemistry. The present study indicates that salivary FNACs are highly beneficial in specialized settings where the pretest probability (P) is assessed to be above 10%, this will be of clinical value. To increase the P, careful, detailed history, accuracy imaging modalities, palpatory findings along with an efficient diagnostic algorithm will be helpful.

Probabilistic approach has been tried in several cytological studies of pathologies with high degree of effectiveness. To the best of our knowledge probabilistic approach to SG cytology was done for the first time and results presented.

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References

A Comment on Assessment of Mild Cognitive Impairment with Mini Mental State Examination Among Adults in Southeast Nigeria

Sir,

Went through article entitled “Assessment of mild cognitive impairment (MCI) with mini mental state examination among adults in Southeast Nigeria” published in your journal (2012;2:99‑102). [1] As pointed out by the authors and as available from literature search on this topic, a score of <24 out of a maximum of 30 in the mini mental state examination (MMSE) defines the abnormal cognitive function. This definition has been widely accepted by authors conducting studies on dementia all over the world working in different socio‑cultural environment.[2‑4] It is now well‑known that MCI, (also known as incipient dementia, or isolated memory impairment) is a brain‑function syndrome involving the onset and evolution of cognitive impairments beyond those expected based on the age and education of the individual, but which are not significant enough to interfere with their daily activities.[5]

The authors have done a decent enough job in focussing on MCI, a rather neglected topic in developing part of the world. However, the concern for me in this study is the cut‑off used by the authors for defining MCI (17 out of a total of 30), which seems arbitrary. Is there a basis for choosing this cut‑off? if yes, this should have been elaborated in detail. I have and continue to work on cognitive impairment in different settings (urban, rural, tribal and migrant), but for me the cut‑off has always remained the same. If at all changes are necessary, it is modifying the MMSE and making it relevant to the local needs.[4]

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References

Author's Response
Dear Editor,

In reply to the comment made with respect to the article, may I respond that the cut‑off of 17 was obtained on the basis of a Gaussian distribution curve with normality established at a range of Mean (2SD). The cut off of 17 for the study population was obtained from this basis. This is an acceptable method of obtaining cut‑off value in a population based study. Moreover, the cut off of 17 was obtained from a pretest/pilot study.

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