Evaluation of knowledge, attitude, and practice regarding positron emission tomography scan: A cross-sectional survey

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Abstract

Background and Objectives: Positron emission tomography (PET) scan is a radionuclide imaging technique with implications in diagnostic and therapeutic oncology. Due to the complexity in the technique and cost factor, this technique has not been popular among the general and specialty dental practitioners. This survey study utilizes the Likert item to evaluate the intensity of response toward the technical and practical aspects of PET scan in dentistry.

Materials and Methods: A representative population of 500 respondents was chosen by randomization. These respondents were either postgraduates or staff of various dental specialties. A close-ended questionnaire was provided inclusive of the Likert items. Simple arithmetic percentages were calculated to evaluate the knowledge and practice. One-way ANOVA test was done to evaluate the Likert items and regression analysis was done to find a correlation between the questions asked in attitude.

Result: Statistically significant values (P = 0.0010) were obtained while evaluating the Likert items. Linear regression analysis showed a strong correlation between the questions asked in attitude.

Conclusion: The overall impression of the survey revealed that the knowledge of the respondents was above optimum. However, the responses in attitude revealed a lack of practical knowledge and inhibitions pertaining to prescribe PET scan in dentistry.

Keywords
Metastasis, positron emission tomography scan, radionuclide imaging

Introduction

Molecular imaging technique is picking up pace worldwide. Positron emission tomography (PET) scan has been recognized as an effective diagnostic aid for diagnosis, prognosis, treatment planning, and monitoring in oncology.¹ PET was introduced way back in 1973 in the USA. Four decades hence, the progress has not been remarkable. The first PET scan machine in India was introduced in 2004 and the projected number by 2015 has been 75.² Lack of standard guidelines for PET/computed tomography (CT) concerning clinical indications, imaging protocols, and image interpretation have resulted in referring physicians expressing considerable uncertainty about the appropriate and the best use of PET/CT.³ Most of the studies have focused on establishing the diagnostic accuracy of PET while the clinical utility of PET on the decision making is poorly reported.⁴⁻⁶

Head and neck squamous cell carcinoma accounts for 3% of cancers globally.⁷ Identifying distant metastasis and treatment planning forms the mainstay of treatment. PET scan can be a useful diagnostic tool in such situations.

This study was done with knowledge, attitude, practice (KAP) questionnaire to evaluate the knowledge among dentists about PET scan and to assess their mindset about the clinical utility of PET by means of evaluating the intensity of their responses.

Materials and Methods

This is a questionnaire-based cross-sectional survey study comprising 500 respondents. These respondents were either postgraduates or staff of various dental colleges of Bangalore. This was a “KAP” questionnaire (KAP) [Figure 1]. “Knowledge and practice” respondents were evaluated by five questions
having two options each. It was evaluated by arithmetic percentage. "Attitude" of the respondents was evaluated based on a 5 point Likert scale, which was evaluated by one-way ANOVA test. "Practice" was evaluated as similar to knowledge by plain arithmetic percentage.

Results

Of 500 respondents, 424 responded positively to the questionnaire. This indicated a drop out percentage of 15%.

<table>
<thead>
<tr>
<th>Knowledge:</th>
<th>Question number</th>
<th>Number of correct answers (%)</th>
<th>Number of wrong answers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the full form of PET?</td>
<td>1</td>
<td>89</td>
<td>11</td>
</tr>
<tr>
<td>Positive Emission Tomography (PET)</td>
<td>2</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>Positron Emission Tomography (PET)</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>4. Does PET use X Rays?</td>
<td>4</td>
<td>15</td>
<td>85</td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
<td>72.48±161.48</td>
<td>95</td>
</tr>
</tbody>
</table>

KAP: Knowledge, attitude, practice

Table 1: Data representing the percentage of correct and wrong answers for knowledge of KAP questionnaire

Table 2: Confidence interval and P=5 point Likert on attitude evaluation by ANOVA test

Table 3: Data representing the percentage of correct and wrong answers for knowledge of KAP questionnaire
which PET scan is advised in the general population by the oncologists itself gives an insight about the perception of PET scan.\(^8\) The basics of radionuclide imaging are incorporated in the dental curriculum in India.\(^9\) However, the scoring for few questions pertaining to the knowledge of PET scan was far from below optimal in our study.

Hotspot indicates an area of increased radiotracer uptake.\(^10\) Mere presence of hotspots is not conclusive about the presence of high tumor activity.\(^11,12\) The respondents in our study had a fair knowledge about the technical aspects of PET scan.\(^13,14\) Fluorodeoxyglucose (F-FDG) is the most widely used PET tracer. FDG is not a specific probe for cancer as it is thought to be nonspecific. However, it can be of great use in identifying stages of the disease by a survey of the whole body.\(^15,16\) Gamma camera (Anger camera) is a scintillation camera which absorbs the discrete energy photons (gamma rays) and converts this energy of absorbed photon into a flash of light which in turn changes to an electrical pulse waves. These are subsequently analyzed.\(^7\)

The attitude of the respondents gives a hindsight view about the intensity of their response. PET scan is not routinely advised by dentists.\(^15\) In accordance to this, the respondents in our study scored the maximum for strong disagreement on the question; “whether PET scan is routinely used in dentistry.” However, PET scan has been advised by dentists for assessing distant metastasis.\(^16\) Increased or decreased radiotracer uptake in a suspected case of neoplasia gives information about the biochemical behavior and physiological activity of the tumor. Numerous studies have shown the difference between benign and malignant lesion based on the radiotracer uptake.\(^17,18\) The respondents in our study had a strong inclination toward the fact that the radiotracer in PET scan has a different biochemical behavior based on the activity of the tumor. The subjects in our study strongly agreed that PET scan can determine the extent of their location and number of metastasis. This is in accordance with the results obtained by Krabbe \textit{et al.}\(^19\) The respondents strongly agreed with the concept of advising PET scan in pregnant women as the fetal radiation dose from \(^{18}\)F-FDG PET is quite low and significantly below the threshold dose for deterministic effects. Although F-FDG is believed to cross the placental membrane and accumulate in the fetus, there are no scientific studies documenting the fetal toxicity associated with it. Fetal dose exposure from F-FDG is low and ranges from 1.1 to 2.43 mGy for various trimesters in pregnancy. This fetal dose exposure is significantly below the threshold dose for deterministic effects due to radiation exposure to the fetus. The threshold was known to be around 100-600 mGy. Dose optimization for pregnant women is done by not using CT along with PET. Instead of CT, a Germanium (\(^{68}\)Ge) rod source is used for attenuation correction. Besides, urinary catheterization is done to drain the bladder, and thus prevent accumulation of radioactive isotope in the fetus.\(^20\)

PET scan is an excellent diagnostic tool for tumor surveillance. The sensitivity of PET scan in identifying distant metastasis was 89%.\(^21,22\) PET scan is a useful tool to monitor the behavior of the tumor in terms of increase in size and biochemical activity.\(^16,23\) Tumor oxygenation is a strong determinant of response to radiotherapy and chemotherapy. Certain PET radiopharmaceuticals have been developed which localized in the area of tissue hypoxia. Distant metastasis is effectively identified by PET scan.\(^17,24\) In our study, the intensity of the respondents was toward a strong agreement in these aspects of PET scan.

PET scan is a recently introduced diagnostic tool in India. The first PET machine in India was acquired as early as 2004.\(^23\) The primary cause of this late advent of PET scan was the initial cost of investment. On an average, a PET scan costs about 6-8 times more than a conventional CT.\(^24\) Besides, due to the

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**Graph 1:** The strong correlation between question 2 and question 3

**Graph 2:** The strong correlation between question 2 and question 5

**Table 3:** Data representing the percentage of correct and wrong answers for practice of KAP questionnaire

<table>
<thead>
<tr>
<th>Question number</th>
<th>Number of correct answers (%)</th>
<th>Number of wrong answers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>83</td>
<td>17</td>
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<tr>
<td>3</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>30</td>
</tr>
</tbody>
</table>

KAP: Knowledge, attitude, practice
limited availability of PET scan centers it has not been a popular diagnostic aid. Our survey opinion too echoes the same. The procedure for PET scan is elaborate. On an average, it takes 20 min for the scan to be completed. Hence, claustrophobia is one of the main disadvantages of PET scan. This practical issue was well understood by our respondents. Tumor localization is one of the greatest challenges in any diagnostic modality. Combining PET scan with CT was a challenge, which was overcome by coupling the sonograms, which map the functional process of the tumor with CT. Thus, a combined PET-CT scan can be obtained with minimum time delay. However, PET-CT adds to significant radiation exposure, which is 5-10 times greater than a normal background radiation. The survey subjects in our study were in agreement with the fact that PET-CT was better in identifying the tumor location, size, and activity. SPECT traces a single radiation and not a simultaneous double one, unlike PET. Hence, the gamma radiations are measured directly because of which the image sensitivity is poor. The radioactive material used in SPECT has a longer biological half-life. This results in subjecting the patient for increased radiation exposure. However, the scoring of respondents on the question of which is better among the two “SPECT or PET” was far below optimal.'

**Conclusion**

This research article is an audit for exploring the popularity of PET scan among dentists in a cross section of the population in India. The knowledge and clinical aptitude of a dental professional appears to the above optimum. However, due to the constraints of availability and cost of PET scan is not routinely advised by oral diagnosticians and oncologists. This in turn influences the perception of the dentist regarding the use of PET scan, which was well highlighted by the “attitude” of our KAP questionnaire. Reforms at a governmental level must be introduced to make PET scan more affordable, thus popularizing its usage.

**References**

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