Introduction

Testicular germ-cell tumours are the commonest malignancy affecting men aged between 20-40 years, with approximately 2000 new diagnoses each year1. These tumours are divided into seminomatous and non-seminomatous types with a majority of cases being mixed.

These types of tumours are highly curable through a combination of surgery, chemotherapy and/or radiotherapy with five-year survival rates in excess of 95%1,2. Accurate staging and response assessment with imaging is vital to ensure that the right patients receive the correct treatment.

Contrast-enhanced CT in combination with tumour markers (o-lymphoprotein, LDH and a-fetoprotein) is the most widely used approach to stage and follow-up germ-cell tumours. Limitations of CECT include an inability to detect malignancy in small nodules (<10mm in short axis diameter) and in post-treatment residual masses, which are present in up to 60% of patients at the end of treatment; up to 15% of these patients eventually relapse1.

PET/CT is a hybrid imaging technique providing both anatomical and functional information, with the latter overcoming some of the limitations of morphological assessment with CT. In this study, we use the Thames Valley germ cell tumour database to retrospectively evaluate the diagnostic accuracy of 18F-FDG PET-CT in germ cell tumours.

Methods

The Thames Valley database is a custom in-house developed database, which holds the details of all patients diagnosed with testicular cancer within the Thames Valley supra-regional network. The database includes outcomes from MDT discussions, brief summaries of clinic attendances, all performed radiological studies, histology results and tumor marker results.

The database was searched to identify patients that had a PET-CT scan during their treatment. PET-CT scans were then classified as either positive or negative based on whether active cancer was identified in the report. A positive PET-CT scan result was then classified as a true positive if there was historical proof of cancer, progressive disease on follow-up imaging, tumour marker rise or disease response after treatment. A negative scan was a true negative if there was no evidence of disease recurrence on follow-up. Other scans were classified as false positives or false negatives.

Results

Table 1 shows the classification of the assessed PET-CT scans. Table 2 shows the sensitivity, specificity, positive and negative likelihood ratios of PET-CT in germ cell tumours.

Table 2: The sensitivities (Sens), specificities (Spec), positive likelihood ratios (PLR) and negative likelihood ratios (NLR) with their respective 95% confidence intervals (95% C.I.)

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Seminoma</th>
<th>Non-seminoma</th>
</tr>
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<tbody>
<tr>
<td><strong>Sens</strong></td>
<td>85.7%</td>
<td>86.6%</td>
<td>84.3%</td>
</tr>
<tr>
<td><strong>Spec</strong></td>
<td>64.1%</td>
<td>60.7%</td>
<td>71.5%</td>
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<tr>
<td><strong>PLR</strong></td>
<td>3.14</td>
<td>1.71</td>
<td>5.77</td>
</tr>
<tr>
<td><strong>NLR</strong></td>
<td>0.20</td>
<td>0.12</td>
<td>0.33</td>
</tr>
</tbody>
</table>

The data shows that 18F-FDG PET-CT has a high sensitivity and diagnostic accuracy in germ-cell tumours in routine clinical practice. It is particularly effective in detecting metabolically active seminoma. Due to its moderate overall specificity, a positive scan should be interpreted with caution, especially if the clinical suspicion of disease is low. Further prospective studies are required to define optimum role of 18F-FDG PET-CT in the management of germ cell tumours.

Discussion and conclusion

The data shows that 18F-FDG PET-CT has good sensitivity for testicular cancer and is hence a good test at excluding the possibility of active malignancy. However, with a sensitivity of approximately 85% interpretation of scan results should be made in combination with other clinical parameters.

The NLR of 0.20 shows that a negative PET-CT provides a moderate reduction (~30%) in the likelihood of disease being present. If in combination with other clinical information, the pre-test probability is low, then a negative PET-CT result can be very reassuring.

The NLR value is much lower, and thus more significant, in seminoma, and is associated with a high sensitivity of 99%. A positive PET-CT in a patient with seminoma provides strong evidence of successful treatment. Although, the number of scans in this study is too low to show a statistically significant difference between seminoma and non-seminoma cases, this finding is in line with findings in other studies and a meta-analyses4,5. A possible reason for why PET-CT is less sensitive in non-seminoma cases is the fact that teratomas have poor FDG uptake.

The specificity of 18F-FDG PET-CT is much lower than the sensitivity at approximately 70%. Similarly, the positive predictive ratio only provides a small moderate increase in the malignancy being present. Hence, a positive PET-CT study should be interpreted with more caution. In combination with tumor markers and CT results, the negative PET-CT can still be very useful.

In conclusion, 18F-FDG PET-CT has a high sensitivity and diagnostic accuracy in germ-cell tumours in routine clinical practice. It is particularly effective in detecting metabolically active seminoma. Due to its moderate overall specificity, a positive scan should be interpreted with caution, especially if the clinical suspicion of disease is low. Further prospective studies are required to define optimum role of 18F-FDG PET-CT in the management of germ cell tumours.

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