Pre-operative differentiation of glioma grades using [99mTc]Tc-HYNIC-PSMA-11 SPECT/CT: a preliminary study

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different between high-grade astrocytoma and GBM, the TPR and PSMA-avid tumor volumes were significantly higher in GBM lesions. In a recent study with PET imaging in 14 GBM cases, TBR was also not correlated with PSMA expression on histologic examination [30]. Although further larger studies are needed, it could be stated that the TPR could potentially differentiate between 3 groups of LGG (TPR:0), high-grade astrocytoma, and GBM. Besides, with increasing attention to theranostic approaches in brain tumors, using clinically relevant objective quantitative parameters can make it more practical and systematic to apply 177Lu- PSMA radio-ligand therapy in GBM [34]. Given the few studies with few cases that evaluated the response of recurrent GBM to ^{177}Lu- PSMA with promising results of higher survival rates [35], this study can also suggest considering this therapeutic potential earlier in the diagnosis of GBM as an adjunct to other treatments [36]. Finally, considering the lower cost and good results, it can be conferred that for the evaluation of PSMA avidity in investigational theranostic studies, ^{99m}Tc-PSMA radiotracers could also be a good alternative to PET PSMA imaging.

It is also found in the current study that metastatic lesions of other origins (squamous cell origin carcinoma and rhabdomyosarcoma) and brain abscesses can present with faint PSMA uptake on visual assessment. These inflammatory or poorly PSMA-avid malignancies also showed a low TPR in the range of 3–9% which was not seen in any LGG or HGG. However, considering the small sample size, this finding should be further evaluated and if confirmed in larger studies, it may be able to potentially narrow the differential diagnosis according to the degree of PSMA uptake.

Limitations

The major limitation of this study is the small sample size, especially in different subgroups, and further larger studies are needed. Alongside the relatively small sample size, the limited availability of histologic and other imaging findings for further comparison analysis is a major limitation. Furthermore, regarding the difference in the degree of PSMA uptake by HGG, prognostic studies are needed to evaluate the clinical relevance of this result. Finally, from the technical point of view and considering the few similar studies in this field, further studies for the evaluation of optimal SPECT technique and time of imaging for this special purpose are also recommended.

Conclusion

As PSMA imaging continues to evolve and gain recognition in neuro-oncology, ongoing research endeavors aim to elucidate its full potential in preoperative evaluation and treatment planning for brain gliomas. This study suggests that ^{99m}Tc-labeled PSMA imaging can also be a good marker in the preoperative differentiation of LGG. It is noteworthy that while MRI is still the standard technique in neuroimaging, the combination of MRI with different techniques such as PSMA imaging can further enhance personalized medicine for gliomas.

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Author contributions All authors contributed to study design and data collection. For data collection, A.B, H.A and A.S referred the patients and T.G, S.S and Z.S acquired and analyzed the scan findings and A.D evaluated and analyzed the pathologic results. The first draft of the manuscript wrote by T.G and all authors reviewed the manuscript.

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Data availability The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

Declarations

Ethical approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the Shiraz University of Medical Sciences (IR. SUMS. MED.REC.1400.277).

Competing interests The authors declare no competing interests.

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