Stimulated Raman Histology for Rapid Intraoperative Diagnosis of Gliomas

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Abstract

Background: Intraoperative pathologic diagnosis traditionally involves frozen section histopathology, which may be labor and time intensive. Indeed, a technique that streamlines the acquisition and evaluation of intraoperative histologic data may expedite surgical decision-making and shorten operative time. Stimulated Raman histology (SRH) is an emerging technology that allows for more rapid acquisition and interpretation of intraoperative histopathologic data.

Methods: A blinded, prospective cohort study was performed for 82 patients undergoing resection for a central nervous system tumor. Of these, 21 patients were diagnosed with glioma either intraoperatively or postoperatively on permanent section histology and included in this study. Time to diagnosis (TTD) and diagnostic accuracy relative to permanent section (the gold standard) were compared between SRH-based diagnosis and conventional frozen section histology. Diagnostic concordance with permanent section was also compared between frozen histopathology and SRH diagnosis.

Results: Diagnostic accuracy was not significantly different between methods (P = 1.00). Diagnostic concordance was not significantly different between methods when comparing 95% confidence intervals for kappa values (κ = 0.215; κ = 0.297; κ = 0.369). Lastly, mean TTD was significantly shorter with SRH-based diagnosis compared with frozen section (43 vs. 9.7 minutes, P < 0.0001). SRH was able to identify key features associated with varying glioma types.

Conclusions: SRH allows for rapid intraoperative diagnosis without sacrificing diagnostic accuracy. SRH may serve as a promising adjuvant to conventional histopathology to expedite intraoperative pathology consultation and surgical decision-making.

Keywords: Brain tumor; Frozen section; Glioma; Pathology; Permanent section; Stimulated Raman histology.