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**International Conference on
Hybrid Imaging (IPET 2024)**

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Library Bibliography

Resources. Day 3

Treatment Response and Imaging.
The following is a non-exhaustive bibliography of systematic reviews that are free to access, published years 2021-2024, on the field of Treatment Response and Imaging.

1. The Clinical Utility of Diffusion-Weighted Imaging in Diagnosing and Predicting Treatment Response of Laryngeal and Hypopharyngeal Carcinoma: a Systematic Review and Meta-Analysis

Abstract

Purpose: Laryngeal and Hypopharyngeal Carcinomas (LC/HPC) constitute about 24 % of head and neck cancers, causing more than 90,000 annual deaths worldwide. Diffusion-Weighted Imaging (DWI), is currently widely studied in oncologic imaging and can aid in distinguishing cellular tumors from other tissues. Our objective was to review the effectiveness of DWI in three areas: diagnosing, predicting prognosis, and predicting treatment response in patients with LC/HPC.

Conclusion: DWI aids significantly in the LC/HPC diagnosis. However, further research is needed to establish DWI's reliability in predicting prognosis and treatment response in patients with LC/HPC.

2. Exercise Training Is Associated With Treatment Response in Liver Fat Content by Magnetic Resonance Imaging Independent of Clinically Significant Body Weight Loss in Patients With Nonalcoholic Fatty Liver Disease: A Systematic Review and Meta-Analysis

Abstract

Introduction: Exercise training is crucial in the management of nonalcoholic fatty liver disease (NAFLD); however, whether it can achieve clinically meaningful improvement in liver fat is unclear. We investigated the association between exercise training and the achievement of validated thresholds of MRI-measured treatment response.

Discussion: Independent of weight loss, exercise training is 3 and a half times more likely to achieve clinically meaningful treatment response in MRI-measured liver fat compared with standard clinical care. An exercise dose of at least 750 metabolic equivalents of task-min/wk seems required to achieve treatment response. These results further support the weight-neutral benefit of exercise in all patients with NAFLD.

3

Performance of Radiomics-Based Artificial Intelligence Systems in the Diagnosis and Prediction of Treatment Response and Survival in Esophageal Cancer: a Systematic Review and Meta-Analysis of Diagnostic Accuracy

Abstract

Radiomics can interpret radiological images with more detail and in less time compared to the human eye. Some challenges in managing esophageal cancer can be addressed by incorporating radiomics into image interpretation, treatment planning, and predicting response and survival. This systematic review and meta-analysis provides a summary of the evidence of radiomics in esophageal cancer. The systematic review was carried out using Pubmed, MEDLINE, and Ovid EMBASE databases-articles describing radiomics in esophageal cancer were included. A meta-analysis was also performed; 50 studies were included. For the assessment of treatment response using 18F-FDG PET/computed tomography (CT) scans, seven studies (443 patients) were included in the meta-analysis. The pooled sensitivity and specificity were 86.5% (81.1-90.6) and 87.1% (78.0-92.8). For the assessment of treatment response using CT scans, five studies (625 patients) were included in the meta-analysis, with a pooled sensitivity and specificity of 86.7% (81.4-90.7) and 76.1% (69.9-81.4). The remaining 37 studies formed the qualitative review, discussing radiomics in diagnosis, radiotherapy planning, and survival prediction. This review explores the wide-ranging possibilities of radiomics in esophageal cancer management. The sensitivities of 18F-FDG PET/CT scans and CT scans are comparable, but 18F-FDG PET/CT scans have improved specificity for AI-based prediction of treatment response. Models integrating clinical and radiomic features facilitate diagnosis and survival prediction. More research is required into comparing models and conducting large-scale studies to build a robust evidence base.

4

LI-RADS Treatment Response versus Modified RECIST for Diagnosing Viable Hepatocellular Carcinoma after Locoregional Therapy: a Systematic Review and Meta-Analysis of Comparative Studies

Abstract

Purpose: To systematically compare the performance of liver imaging reporting and data system treatment response (LR-TR) with the modified Response Evaluation Criteria in Solid Tumors (mRECIST) for diagnosing viable hepatocellular carcinoma (HCC) treated with locoregional therapy (LRT).

Conclusion: The LR-TR algorithm demonstrated better specificity than mRECIST, without a significant difference in sensitivity for the diagnosis of pathologically viable HCC after LRT.

⑤ Diagnostic Accuracy of MRI Techniques for Treatment Response Evaluation in Patients with Brain Metastasis: a Systematic Review and Meta-Analysis

Abstract

Background: Treatment response assessment in patients with brain metastasis uses contrast enhanced T1-weighted MRI. Advanced MRI techniques have been studied, but the diagnostic accuracy is not well known. Therefore, we performed a metaanalysis to assess the diagnostic accuracy of the currently available MRI techniques for treatment response.

Results: Anatomical MRI (16 studies, 726 lesions) showed a pooled sensitivity of 79% and a specificity of 76%. DCE perfusion (4 studies, 114 lesions) showed a pooled sensitivity of 74% and a specificity of 92%. DSC perfusion (12 studies, 418 lesions) showed a pooled sensitivity was 83% with a specificity of 78%. Diffusion weighted imaging (7 studies, 288 lesions) showed a pooled sensitivity of 67% and a specificity of 79%. MRS (4 studies, 54 lesions) showed a pooled sensitivity of 80% and a specificity of 78%. Combined techniques (6 studies, 375 lesions) showed a pooled sensitivity of 84% and a specificity of 88%. External validation of DSC showed a lower sensitivity and a higher specificity for the reported cut-off values included in this metaanalysis.

Conclusion: A combination of techniques shows the highest diagnostic accuracy differentiating tumor progression from treatment induced abnormalities. External validation of imaging results is important to better define the reliability of imaging results with the different techniques.

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⑥ 18F-FDG PET Radiomics as Predictor of Treatment Response in Oesophageal Cancer: a Systematic Review and Meta-Analysis

Abstract

The best treatment strategy for oesophageal cancer patients achieving a complete clinical response after neoadjuvant chemoradiation is a burning topic. The available diagnostic tools, such as 18F-FDG PET/CT performed routinely, cannot accurately evaluate the presence or absence of the residual tumour. The emerging field of radiomics may encounter the critical challenge of personalised treatment. Radiomics is based on medical image analysis, executed by extracting information from many image features; it has been shown to provide valuable information for predicting treatment responses in oesophageal cancer. This systematic review with a meta-analysis aims to provide current evidence of 18F-FDG PET-based radiomics in predicting response treatments following neoadjuvant chemoradiotherapy in oesophageal cancer. A comprehensive literature review identified 1160 studies, of which five were finally included in the study. Our findings provided that pooled Area Under the Curve (AUC) of the five selected studies was relatively high at 0.821 (95% CI: 0.737-0.904) and not influenced by the sample size of the studies. Radiomics models exhibited a good performance in predicting pathological complete responses (pCRs). This review further strengthens the great potential of 18F-FDG PET-based radiomics to predict pCRs in oesophageal cancer patients who underwent neoadjuvant chemoradiotherapy. Additionally, our review imparts additional support to prospective studies on 18F-FDG PET radiomics for a tailored treatment strategy of oesophageal cancer patients.

(7) Early Prediction and Monitoring of Treatment Response in Gastrointestinal Stromal Tumors by Means of Imaging: a Systematic Review

Weeda YA, Kalisvaart GM, van Velden FHP, Gelderblom H, van der Molen AJ, Bovee JVMG, van der Hage JA, Grootjans W, de Geus-Oei LF.Diagnostics (Basel). 2022 Nov 7;12(11):2722. doi: 10.3390/diagnostics12112722.PMID: 36359564. Review.

Abstract

Gastrointestinal stromal tumors (GISTs) are rare mesenchymal neoplasms. Tyrosine kinase inhibitor (TKI) therapy is currently part of routine clinical practice for unresectable and metastatic disease. It is important to assess the efficacy of TKI treatment at an early stage to optimize therapy strategies and eliminate futile ineffective treatment, side effects and unnecessary costs. This systematic review provides an overview of the imaging features obtained from contrast-enhanced (CE)-CT and 2-deoxy-2-[18F]fluoro-D-glucose ([18F]FDG) PET/CT to predict and monitor TKI treatment response in GIST patients. PubMed, Web of Science, the Cochrane Library and Embase were systematically screened. Articles were considered eligible if quantitative outcome measures (area under the curve (AUC), correlations, sensitivity, specificity, accuracy) were used to evaluate the efficacy of imaging features for predicting and monitoring treatment response to various TKI treatments. The methodological quality of all articles was assessed using the Quality Assessment of Diagnostic Accuracy Studies, v2 (QUADAS-2) tool and modified versions of the Radiomics Quality Score (RQS). A total of 90 articles were included, of which 66 articles used baseline [18F]FDG-PET and CE-CT imaging features for response prediction. Generally, the presence of heterogeneous enhancement on baseline CE-CT imaging was considered predictive for high-risk GISTs, related to underlying neovascularization and necrosis of the tumor. The remaining articles discussed therapy monitoring. Clinically established imaging features, including changes in tumor size and density, were considered unfavorable monitoring criteria, leading to under- and overestimation of response. Furthermore, changes in glucose metabolism, as reflected by [18F]FDG-PET imaging features, preceded changes in tumor size and were more strongly correlated with tumor response. Although CE-CT and [18F]FDG-PET can aid in the prediction and monitoring in GIST patients, further research on cost-effectiveness is recommended.

(8) Imaging Biomarkers of Glioblastoma Treatment Response: a Systematic Review and Meta-Analysis of Recent Machine Learning Studies

Booth TC, Grzeda M, Chelliah A, Roman A, Al Busaidi A, Dragos C, Shuaib H, Luis A, Mirchandani A, Alparslan B, Mansoor N, Lavrador J, Vergani F, Ashkan K, Modat M, Ourselin S.Front Oncol. 2022 Jan 31;12:799662. doi: 10.3389/fonc.2022.799662. eCollection 2022.PMID: 35174084.

Abstract

Objective: Monitoring biomarkers using machine learning (ML) may determine glioblastoma treatment response. We systematically reviewed quality and performance accuracy of recently published studies.

Conclusion: ML models using MRI features to distinguish between progression and mimics appear to demonstrate good diagnostic performance. However, study quality and design require improvement.

9 A Systematic Review of Amino Acid PET in Assessing Treatment Response to Temozolomide in Glioma

Abstract

The response assessment in neuro-oncology (RANO) criteria have been the gold standard for monitoring treatment response in glioblastoma (GBM) and differentiating tumor progression from pseudoprogression. While the RANO criteria have played a key role in detecting early tumor progression, their ability to identify pseudoprogression is limited by post-treatment damage to the blood-brain barrier (BBB), which often leads to contrast enhancement on MRI and correlates poorly to tumor status. Amino acid positron emission tomography (AA PET) is a rapidly growing imaging modality in neuro-oncology. While contrast-enhanced MRI relies on leaky vascularity or a compromised BBB for delivery of contrast agents, amino acid tracers can cross the BBB, making AA PET particularly well-suited for monitoring treatment response and diagnosing pseudoprogression. The authors performed a systematic review of PubMed, MEDLINE, and Embase through December 2021 with the search terms "temozolomide" OR "Temodar," "glioma" OR "glioblastoma," "PET," and "amino acid." There were 19 studies meeting inclusion criteria. Thirteen studies utilized [18F]FET, five utilized [11C]MET, and one utilized both. All studies used static AA PET parameters to evaluate TMZ treatment in glioma patients, with nine using dynamic tracer parameters in addition. Throughout these studies, AA PET demonstrated utility in TMZ treatment monitoring and predicting patient survival.

10 Meta-Analysis and Systematic Review of Contrast-Enhanced Ultrasound in Evaluating the Treatment Response after Locoregional Therapy of Hepatocellular Carcinoma

Abstract

Purpose: Contrast-enhanced ultrasound (CEUS) is a useful tool to assess treatment response after percutaneous ablation or transarterial chemoembolization (TACE) of hepatocellular carcinoma (HCC). Here, we performed a systematic review and meta-analysis to evaluate the usefulness of CEUS in identifying residual tumor after locoregional therapy.

Conclusion: CEUS is a highly accurate method to identify HCC residual tumor after TACE or percutaneous ablation.

⑪ Diffusion-Weighted MRI for Predicting Treatment Response in Patients with Nasopharyngeal Carcinoma: a Systematic Review and Meta-Analysis

Abstract

Early prediction of treatment response in nasopharyngeal carcinoma is clinically relevant for optimizing treatment strategies. This meta-analysis was performed to evaluate whether apparent diffusion coefficient (ADC) from diffusion-weighted imaging (DWI) can predict treatment response of patients with nasopharyngeal carcinoma. A systematic search of PubMed-MEDLINE and Embase was performed to identify relevant original articles until July 22, 2021. We included studies which performed DWI for predicting locoregional treatment response in nasopharyngeal carcinoma treated with neoadjuvant chemotherapy, definitive chemoradiation, or radiation therapy. Hazard ratios were meta-analytically pooled using a random-effects model for the pooled estimates of overall survival, local relapse-free survival, distant metastasis-free survival and their 95% CIs. ADC showed a pooled sensitivity of 87% (95% CI 72-94%) and specificity of 70% (95% CI 56-80%) for predicting treatment response. Significant between-study heterogeneity was observed for both pooled sensitivity (I2 = 68.5%) and specificity (I2 = 92.2%) (P < 0.01). The pooled hazard ratios of low pretreatment ADC for assessing overall survival, local relapse-free survival, and distant metastasis-free survival were 1.42 (95% CI 1.09-1.85), 2.31 (95% CI 1.42-3.74), and 1.35 (95% CI 1.05-1.74), respectively. In patients with nasopharyngeal carcinoma, pretreatment ADC demonstrated good predictive performance for treatment response.

⑫ Per-Feature Accuracy of Liver Imaging Reporting and Data System Locoregional Treatment Response Algorithm: a Systematic Review and Meta-Analysis

Abstract

We aimed to investigate the accuracy of each imaging feature of LI-RADS treatment response (LR-TR) viable category for diagnosing tumor viability of locoregional therapy (LRT)-treated HCC. Studies evaluating the per feature accuracy of the LR-TR viable category on dynamic contrast-enhanced CT or MRI were identified in databases. A bivariate random-effects model was used to calculate the pooled sensitivity, specificity, and diagnostic odds ratio (DOR) of LR-TR viable features. Ten studies assessing the accuracies of LR-TR viable features (1153 treated observations in 971 patients) were included. The pooled sensitivities and specificities for diagnosing viable HCC were 81% (95% confidence interval [CI], 63-92%) and 95% (95% CI, 88-98%) for nodular, mass-like, or irregular thick tissue (NMLIT) with arterial phase hyperenhancement (APHE), 55% (95% CI, 34-75%) and 96% (95% CI, 94-98%) for NMLIT with washout appearance, and 21% (95% CI, 6-53%) and 98% (95% CI, 92-100%) for NMLIT with enhancement similar to pretreatment, respectively. Of these features, APHE showed the highest pooled DOR (81 [95% CI, 25-261]), followed by washout appearance (32 [95% CI, 13-82]) and enhancement similar to pretreatment (14 [95% CI, 5-39]). In conclusion, APHE provided the highest sensitivity and DOR for diagnosing viable HCC following LRT, while enhancement similar to pretreatment showed suboptimal performance.

13 **LI-RADS Treatment Response Algorithm for Detecting Incomplete Necrosis in Hepatocellular Carcinoma after Locoregional Treatment: a Systematic Review and Meta-Analysis Using Individual Patient Data**

Kim TH, Woo S, Joo I, Bashir MR, Park MS, Burke LMB, Mendiratta-Lala M, Do RKG.Abdom Radiol (NY). 2021 Aug;46(8):3717-3728. doi: 10.1007/s00261-021-03122-8. Epub 2021 May 23.PMID: 34027566.

Abstract

Purpose: To perform a systematic review and meta-analysis using individual patient data to investigate the diagnostic performance of Liver Imaging Reporting and Data System (LI-RADS) Treatment Response (TR) algorithm for detecting incomplete necrosis on pathology.

Conclusions: LI-RADS TR algorithm shows moderate sensitivity and high specificity for detecting incomplete necrosis after LRT. APHE is the dominant criterion, a washout contributes to small but meaningful extent, while the contribution of enhancement similar to pretreatment may be negligible. LRT type may affect performance of the algorithm.

14 **The Incidence and Treatment Response of Double Expression of MYC and BCL2 in Patients with Diffuse Large B-Cell Lymphoma: A Systematic Review and Meta-Analysis**

Hwang J, Suh C, Kim K, Kim H, Kim AI, Craig JW, Chen KX, Roberson J, Guenette JP, Huang RY.Cancers (Basel). 2021 Jul 5;13(13):3369. doi: 10.3390/cancers13133369.PMID: 34282799. Review.

Abstract

MYC/BCL2 protein co-expression (i.e., double expressor) has been shown to be a negative predictor of outcome in diffuse large B-cell lymphoma (DLBCL). We aimed to establish the incidence of double expressor status in patients with de novo DLBCL and identify the predictive value of this biomarker on treatment response through systematic review and meta-analysis. PubMed and Embase were searched for studies published through December 2019 that reported proportions of double expressor DLBCL. The pooled proportions of MYC and BCL2 expression, both alone and in combination, were computed using the inverse variance method for calculating weights and by the DerSimonian-Laird method. The pooled odds ratios (ORs) of complete remission (CR) rate were calculated, and meta-regression analysis was conducted to explore heterogeneity. Forty-one studies (7054 patients) were included. The pooled incidence of double expressor status in DLBCL was 23% (95% confidence interval [CI], 20-26%), with an adjusted estimate of 31% (95% CI, 27-36%). Neither MYC/BCL2 protein cutoff values, race, mean, or median age of included patients, or overall study quality was a significant factor of heterogeneity (p ≥ 0.20). Cases without double expressor status demonstrated a higher probability of CR to rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone treatment (OR, 2.69; 95% CI, 1.55-4.67). Our results reaffirm the predictive power of this important biomarker.

15 [**Treatment Response, Survival, and Safety of Transarterial Chemoembolization With CalliSpheres() Microspheres Versus Conventional Transarterial Chemoembolization in Hepatocellular Carcinoma: a Meta-Analysis**](#)

Liang B, Makamure J, Shu S, Zhang L, Sun T, Zheng C.

Abstract

Background: Drug-eluting embolic transarterial chemoembolization (DEE-TACE) is an advance in TACE technique. However, at present there is insufficient evidence to support that DEE-TACE is superior to conventional TACE (cTACE) for hepatocellular carcinoma (HCC). The aim of this meta-analysis is to evaluate the efficacy and safety of TACE with CalliSpheres® microspheres (CSM-TACE) compared with cTACE in patients with HCC.

Conclusion: CSM-TACE displays superior treatment response, non-inferior survival profile and safety over cTACE in HCC patients.

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16 [**Interreader Reliability of Liver Imaging Reporting and Data System Treatment Response: a Systematic Review and Meta-Analysis**](#)

Kim DW, Choi SH, Lee JS, Kim SY, Lee SJ, Byun JH.

Abstract

Background: For a proper management strategy in patients with locoregionally treated hepatocellular carcinoma (HCC), it is essential that the Liver Imaging Reporting and Data System (LI-RADS) treatment response algorithm (LR-TR) has high interreader reliability. We aimed to systematically evaluate the interreader reliability of LR-TR and sources of any study heterogeneity.

Conclusion: LR-TR showed substantial interreader reliability regardless of the imaging modality. Because of substantial study heterogeneity, which was significantly associated with study design and type of treatment, published values for the interreader reliability of LR-TR should be interpreted with care.

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Resources. Day 3

Imaging in Paediatric Oncology.
The following is a non-exhaustive bibliography of systematic reviews that are free to access, published years 2021-2024 on the field of Imaging in Paediatric Oncology.

(17) The Evidence-Based Role of Catecholaminergic PET Tracers in Neuroblastoma. A Systematic Review and a Head-to-Head Comparison with mIBG Scintigraphy

Piccardo A, Treglia G, Fiz F, Bar-Sever Z, Bottoni G, Biassoni L, Borgwardt L, de Keizer B, Jehanno N, Lopci E, Kurch L, Massollo M, Nadel H, Roca Bielsa I, Shulkin B, Vali R, De Palma D, Cecchin D, Santos AI, Zucchetta P.Eur J Nucl Med Mol Imaging. 2024 Feb;51(3):756-767. doi: 10.1007/s00259-023-06486-9. Epub 2023 Nov 14.PMID: 37962616.

Abstract

Background: Molecular imaging is pivotal in staging and response assessment of children with neuroblastoma (NB). [123I]-metaiodobenzylguanidine (mIBG) is the standard imaging method; however, it is characterised by low spatial resolution, time-consuming acquisition procedures and difficult interpretation. Many PET catecholaminergic radiotracers have been proposed as a replacement for [123I]-mIBG, however they have not yet made it into clinical practice. We aimed to review the available literature comparing head-to-head [123I]-mIBG with the most common PET catecholaminergic radiopharmaceuticals.

Conclusions: PET/CT using catecholaminergic tracers shows superior diagnostic performance than mIBG scintigraphy. However, it is still unknown if such superiority can influence clinical decision-making. Nonetheless, the PET examination appears promising for clinical practice as it offers faster image acquisition, less need for sedation, and a single-day examination.

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(18) Diagnostic Performance of Adult-Based Ultrasound Risk Stratification Systems in Pediatric Thyroid Nodules: a Systematic Review and Meta-Analysis

Xing Z, Qiu Y, Zhu J, Su A, Wu W.Front Endocrinol (Lausanne). 2023 May 12;14:1187935. doi: 10.3389/fendo.2023.1187935. eCollection 2023.PMID: 37251670

Abstract

Purpose: Ultrasound (US) is the first choice in the detection of thyroid nodules in pediatric and adult patients. The purpose of this study was to evaluate the diagnostic performance of adult-based US risk stratification systems (RSSs) when applied to the pediatric population.

Conclusions: In conclusion, the ACR-TIRADS, ATA, and EU-TIRADS have moderate diagnostic performance in pediatric thyroid nodule patients. The diagnostic efficacy of the K-TIRADS was not as high as expected. However, the diagnostic performance of Kwak-TIRADS was uncertain because of the small sample size and small number of studies included. More studies are needed to evaluate these adult-based RSSs in pediatric patients with thyroid nodules. RSSs specific for pediatric thyroid nodules and thyroid malignancies were necessary.

Resources. Day 3

Imaging in Paediatric Oncology

19   **Structural and Functional Brain Imaging in Long-Term Survivors of Childhood Acute Lymphoblastic Leukemia Treated With Chemotherapy: A Systematic Review**

Abstract

Background: The effect of chemotherapy on brain development in long-term survivors of pediatric acute lymphoblastic leukemia (ALL) was systematically reviewed.

Conclusion: Although the neurotoxic effects of cancer treatment are reduced in the absence of cranial radiation, survivors treated on chemotherapy-only protocols still display long-term alterations in brain structure and function, which contribute to lifelong neurocognitive late effects.

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20   **Whole-Body Magnetic Resonance Imaging for the Diagnosis of Metastasis in Children and Adolescents: a Systematic Review and Meta-Analysis**

Abstract

Whole-body magnetic resonance imaging (WB-MRI) is a noninvasive imaging method that can be used to diagnose and stage tumors, as well as to assess therapeutic responses in oncology. The objective of this meta-analysis was to evaluate the accuracy of WB-MRI for the diagnosis of metastases in pediatric patients. The following electronic databases were searched: Medline, Embase, Cochrane Central Register of Controlled Trials, Scientific Electronic Library Online, Latin-American and Caribbean Health Sciences Literature, Cumulative Index to Nursing and Allied Health Literature, Web of Science, and ClinicalTrials.gov. All of the selected studies included children and adolescents with histopathological confirmation of a primary tumor. Collectively, the studies included 118 patients ranging in age from 7 months to 19 years. The pooled sensitivity and specificity of WB-MRI were, respectively, 0.964 (95% CI: 0.944-0.978; I 2 = 0%) and 0.902 (95% CI: 0.882-0.919; I 2 = 98.4%), with an area under the curve (AUC) of 0.991. We found that WB-MRI had good accuracy for the diagnosis of metastases in pediatric patients and could therefore provide an alternative to complete the staging of tumors in such patients, being a safer option because it does not involve the use of ionizing radiation.

21 FDG-PET/CT Versus Bone Marrow Biopsy in Bone Marrow Involvement in Newly Diagnosed Paediatric Lymphoma: a Systematic Review and Meta-Analysis

Abstract

Background: Bone marrow infiltration (BMI) is a devastating stage of paediatric lymphoma. Prompt diagnosis of BMI in newly diagnosed paediatric lymphoma patients is critical but can be very challenging at present.

Conclusion: Compared with BMB, FDG-PET/CT was a more valuable diagnostic method for evaluating BMI in paediatric Hodgkin and non-Hodgkin lymphoma patients with extremely high diagnostic accuracy.

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22 Diagnostic Performance of (18)F-FDG PET(CT) in Bone-Bone Marrow Involvement in Pediatric Neuroblastoma: A Systemic Review and Meta-Analysis

Abstract

Objective: We sought to perform a systemic review and meta-analysis of the diagnostic performance of 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography (computed tomography) (PET(CT)) in detection of bone and/or bone marrow involvement (BMI) in pediatric neuroblastoma (NB).

Conclusions: Through a meta-analysis, this study suggested that 18F-FDG PET(CT) has a good overall diagnostic accuracy in the detection of bone/BMI in pediatric neuroblastoma.

(23) ## Whole-Body Magnetic Resonance Imaging in Children - How and Why? A Systematic review

Abstract

Whole-body magnetic resonance imaging (MRI) is increasingly being used for a number of indications. Our aim was to review and describe indications and scan protocols for diagnostic value of whole-body MRI for multifocal disease in children and adolescents, we conducted a systematic search in Medline, Embase and Cochrane for all published papers until November 2018. Relevant subject headings and free text words were used for the following concepts: 1) whole-body, 2) magnetic resonance imaging and 3) child and/or adolescent. Included were papers in English with a relevant study design that reported on the use and/or findings from whole-body MRI examinations in children and adolescents. This review includes 54 of 1,609 papers identified from literature searches. Chronic nonbacterial osteomyelitis, lymphoma and metastasis were the most frequent indications for performing a whole-body MRI. The typical protocol included a coronal STIR (short tau inversion recovery) sequence with or without a coronal T1-weighted sequence. Numerous studies lacked sufficient data for calculating images resolution and only a few studies reported the acquired voxel volume, making it impossible for others to reproduce the protocol/images. Only a minority of the included papers assessed reliability tests and none of the studies documented whether the use of whole-body MRI affected mortality and/or morbidity. Our systematic review confirms significant variability of technique and the lack of proven validity of MRI findings. The information could potentially be used to boost attempts towards standardization of technique, reporting and guidelines development.

Resources. Day 3

Neuroimaging and Dementias.
The following is a non-exhaustive bibliography of systematic reviews that are free to access, published years 2021-2024 on the field of Neuroimaging and Dementias.

24 Technological Frontiers in Brain Cancer: A Systematic Review and Meta-Analysis of Hyperspectral Imaging in Computer-Aided Diagnosis Systems

Abstract

Brain cancer is a substantial factor in the mortality associated with cancer, presenting difficulties in the timely identification of the disease. The precision of diagnoses is significantly dependent on the proficiency of radiologists and neurologists. Although there is potential for early detection with computer-aided diagnosis (CAD) algorithms, the majority of current research is hindered by its modest sample sizes. This meta-analysis aims to comprehensively assess the diagnostic test accuracy (DTA) of computer-aided design (CAD) models specifically designed for the detection of brain cancer utilizing hyperspectral (HSI) technology. We employ Quadas-2 criteria to choose seven papers and classify the proposed methodologies according to the artificial intelligence method, cancer type, and publication year. In order to evaluate heterogeneity and diagnostic performance, we utilize Deeks' funnel plot, the forest plot, and accuracy charts. The results of our research suggest that there is no notable variation among the investigations. The CAD techniques that have been examined exhibit a notable level of precision in the automated detection of brain cancer. However, the absence of external validation hinders their potential implementation in real-time clinical settings. This highlights the necessity for additional studies in order to authenticate the CAD models for wider clinical applicability.

25 Revolutionizing Early Alzheimer's Disease and Mild Cognitive Impairment Diagnosis: a Deep Learning MRI Meta-Analysis

Abstract

Background: The early diagnosis of Alzheimer's disease (AD) and mild cognitive impairment (MCI) remains a significant challenge in neurology, with conventional methods often limited by subjectivity and variability in interpretation. Integrating deep learning with artificial intelligence (AI) in magnetic resonance imaging (MRI) analysis emerges as a transformative approach, offering the potential for unbiased, highly accurate diagnostic insights.

Results: A total of 18 eligible studies were identified. The Spearman correlation coefficient was -0.6506. Meta-analysis showed that the combined sensitivity and specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio were 0.84, 0.86, 6.0, 0.19, and 32, respectively. The AUROC was 0.92. The quiescent point of hierarchical summary of receiver operating characteristic (HSROC) was 3.463. Notably, the images of 12 studies were acquired by T1-weighted MRI alone, and those of the other 6 were gathered by non-T1-weighted MRI alone.

Conclusion: Overall, deep learning of MRI for the diagnosis of AD and MCI showed good sensitivity and specificity and contributed to improving diagnostic accuracy.

26 Appropriate incorporation of Susceptibility-Weighted Magnetic Resonance Imaging into Routine Imaging Protocols for Accurate Diagnosis of Traumatic Brain Injuries: a Systematic Review

Abstract

Traumatic brain injury (TBI) results from physical or traumatic injuries to the brain's surrounding bony structures and associated tissues, which can lead to various sequelae, including simple concussion, acute epidural hematoma, parenchymal contusions, subarachnoid hemorrhage, diffuse axonal injury, and chronic traumatic encephalopathy. Susceptibility-weighted imaging (SWI) has enhanced the accuracy of neuroimaging for these injuries. SWI is based on 3D gradient echo magnetic resonance imaging (MRI) with long echo times and flow compensation. Owing to its sensitivity to deoxyhemoglobin, hemosiderin, iron, and calcium, SWI is extremely informative and superior to conventional MRI for the diagnosis and follow-up of patients with acute, subacute, and prolonged hemorrhage. This systematic review aimed to evaluate and summarize the published articles that report SWI results for the evaluation of TBI and to determine correlations between clinical status and SWI results. Consequently, our analysis also aimed to identify the appropriate MRI sequences to use in the assessment of patients with TBI. We searched the Medline and Embase online electronic databases for relevant papers published from 2012 onwards. We found that SWI had higher sensitivity than gradient echo MRI in detecting and characterizing microbleeds in TBIs and was able to differentiate diamagnetic calcifications from paramagnetic microhemorrhages. However, it is important that future research not only continues to evaluate the utility of SWI in TBIs but also attempts to overcome the limitations of the studies described in this review, which should help validate the conclusions and recommendations from our analysis.

27 Neural Computation-Based Methods for the Early Diagnosis and Prognosis of Alzheimer's Disease Not Using Neuroimaging Biomarkers: a Systematic Review

Abstract

Background: The growing number of older adults in recent decades has led to more prevalent geriatric diseases, such as strokes and dementia. Therefore, Alzheimer's disease (AD), as the most common type of dementia, has become more frequent too.

Background: Objective: The goals of this work are to present state-of-the-art studies focused on the automatic diagnosis and prognosis of AD and its early stages, mainly mild cognitive impairment, and predicting how the research on this topic may change in the future.

Conclusions: The introduction of CNNs in the last decade and their superb results with neuroimaging data did not negatively affect the usage of other modalities. In fact, new ones emerged.

28 Diagnostic Accuracy of Optic Nerve Sheath Diameter on Ultrasound for the Detection of Increased Intracranial Pressure in Patients with Traumatic Brain Injury: a Systematic Review and Meta-Analysis

Abstract

The timely diagnosis and treatment of elevated intracranial pressure (ICP) reduces morbidity rates and prevents mortality. The aim of the present systematic review and meta-analysis was to determine the diagnostic accuracy of optic nerve sheath diameter (ONSD) vs. standard invasive ICP measurements in patients with traumatic brain injury (TBI). The PubMed, Embase, Web of Science and Cochrane Library databases were systematically searched for studies including adult patients with TBI with suspected elevated ICP, and the sonographic ONSD measurements were compared with those from a standard invasive method. The quality of the studies was assessed using the Quality Assessment of Diagnostic Accuracy Studies-2 tool by two independent authors. A bivariate random effects model was used to summarize the pooled sensitivity, specificity and diagnostic odds ratio (DOR). A total of eight prospective studies with 222 patients with TBI were included. The pooled sensitivity was 0.82 [95% confidence interval (CI), 0.75-0.88], the specificity was 0.82 (95% CI, 0.71-0.90) and the DOR was 17.75 (95% CI, 7.02-44.83) with partial evidence of heterogeneity. The accuracy of the area under the summary ROC was 0.87. An ultrasound-determined elevated ICP has reasonable performance indicators with high sensitivity and specificity in patients with TBI. As such, this method may be a useful complementary monitoring tool in acute care.

29 Arterial Spin Labeling (ASL-MRI) versus Fluorodeoxyglucose-PET (FDG-PET) in Diagnosing Dementia: a Systematic Review and Meta-Analysis

Abstract

Background: Dementia is generally caused by neurodegenerative diseases affecting the brain, which leads to a progressive neurocognitive decline characterized by inability to perform major higher functioning tasks. Fluorodeoxyglucose-positron emission tomography (FDG-PET) scan is one of the main imaging tests performed for diagnostic purposes. However, with FDG-PET being quite expensive and not widely available, an attempt to find an alternative is set. Arterial-spin-labelling magnetic resonance imaging (ASL-MRI) is an increasingly investigated substitute to FDG-PET for the diagnosis of dementia. Thereby, the main purpose of this systematic review and meta-analysis is to compare the diagnostic ability of FDG-PET and ASL-MRI in detecting dementia.

Conclusions: Comparing the diagnostic value of FDG-PET and ASL-MRI, the results of this systematic review and meta-analysis indicate that FDG-PET still has an advantage over ASL-MRI. Such implication could be related to the technical differences relating to both modalities, with ASL-MRI having lower temporal resolution. It's worth mentioning that specificity was rather quite similar among both modalities and some studies found an overridden metabolic and perfused images. These findings call for future research to focus their scope of investigation while exploring the diagnostic value of ASL-MRI.

Resources. Day 3

Neuroimaging and Dementias

30 The Role and Potential of Using Quantitative MRI Biomarkers for Imaging Guidance in Brain Cancer Radiotherapy Treatment Planning: a Systematic Review

Abstract

Background and purpose: Improving the accuracy of brain tumour radiotherapy (RT) treatment planning is important to optimise patient outcomes. This systematic review investigates primary studies providing clinical evidence for the integration of quantitative magnetic resonance imaging (qMRI) biomarkers and MRI radiomics to optimise brain tumour RT planning.

Conclusions: Integration of qMRI metrics into RT planning offers the potential to improve delineation and OAR sparing. Clinical trials and consensus guidelines are required to demonstrate the clinical benefits of such approaches.

31 The Diagnostic Performance of Functional Dopaminergic Scintigraphic Imaging in The Diagnosis of Dementia with Lewy Bodies: an Updated Systematic Review

Abstract

Introduction: Dopaminergic scintigraphic imaging is a cornerstone to support the diagnosis in dementia with Lewy bodies. To clarify the current state of knowledge on this imaging modality and its impact on clinical diagnosis, we performed an updated systematic review of the literature.

Conclusion: Our systematic review confirms the major role of dopaminergic scintigraphic imaging in the assessment of dementia with Lewy bodies. Early diagnosis could be facilitated by identifying the prodromes of dementia with Lewy bodies using dopaminergic scintigraphic imaging coupled with emphasis on clinical neuropsychiatric symptoms. Most published studies use a semi-quantitative analytical assessment of tracer uptake, while there are no studies using quantitative analytical methods to measure dopamine transporter loss. The superiority of a purely quantitative approach to assess dopaminergic transmission more accurately needs to be further clarified.

(32) ### Imaging the Brain and Vascular Reactions to Headache Treatments: a Systematic Review

Abstract

Background: Neuroimaging studies have made an important contribution to our understanding of headache pathophysiology. This systematic review aims to provide a comprehensive overview and critical appraisal of mechanisms of actions of headache treatments and potential biomarkers of treatment response disclosed by imaging studies.

Conclusion: Several aspects of headache treatments remain to be elucidated using imaging approaches, such as how pharmacological preventive therapies work, whether treatment-related brain changes may influence therapy effectiveness, and imaging biomarkers of clinical response. In the future, well-designed studies with homogeneous study populations, adequate sample sizes and statistical approaches are needed.

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(33) ### Prognostic Value of Initial Diagnostic Imaging Findings for Patient Outcomes in Adult Patients with Traumatic Brain Injury: a Systematic Review and Meta-Analysis

Abstract

Introduction: Termed the "silent epidemic," traumatic brain injury (TBI) is one of the greatest global contributors not only to post-traumatic death but also to post-traumatic long-term disability. This systematic review and meta-analysis aims to specifically evaluate the prognostic value of features on initial imaging completed within 24 h of arrival in adult patients with TBI.

Conclusion: In meta-analysis, only SDH with mortality in all TBI patients had a moderate but significant association. Given the small number of studies, additional research focused on initial imaging, particularly for imaging modalities other than NECT, is required in order to confirm the findings of our meta-analysis and to further evaluate the association of imaging findings and outcome.

(34) Adoption of Hybrid MRI-Linac Systems for the Treatment of Brain Tumors: A Systematic Review of the Current Literature Regarding Clinical and Technical Features

Guerini AE, Nici S, Magrini SM, Riga S, Toraci C, Pegurri L, Facheris G, Cozzaglio C, Farina D, Liserre R, Gasparotti R, Ravanelli M, Rondi P, Spiazzi L, Buglione M.Technol Cancer Res Treat. 2023 Jan-Dec;22:15330338231199286. doi: 10.1177/15330338231199286.PMID: 37774771. Review.

Abstract

Background: Possible advantages of magnetic resonance (MR)-guided radiation therapy (MRgRT) for the treatment of brain tumors include improved definition of treatment volumes and organs at risk (OARs) that could allow margin reductions, resulting in limited dose to the OARs and/or dose escalation to target volumes. Recently, hybrid systems integrating a linear accelerator and an magnetic resonance imaging (MRI) scan (MRI-linacs, MRL) have been introduced, that could potentially lead to a fully MRI-based treatment workflow.

Conclusions: The adoption of an MRI-only workflow is feasible and could offer several advantages for the treatment of brain tumors, including superior image quality for lesions and OARs and the possibility to adapt the treatment plan on the basis of daily MRI. The growing body of clinical data will clarify the potential benefit in terms of toxicity and response to treatment.

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(35) Differentiation of High Grade Glioma and Solitary Brain Metastases by Measuring Relative Cerebral Blood Volume and Fractional Anisotropy: a Systematic Review and Meta-Analysis Of MRI Diagnostic Test Accuracy Studies

Fioni F, Chen SJ, Lister INE, Ghalwash AA, Long MZ.Br J Radiol. 2023 Jan 1;96(1141):20220052. doi: 10.1259/bjr.20220052. Epub 2022 Dec 8.PMID: 36278795.

Abstract

Objective: This study aims to research the efficacy of MRI (I) for differentiating high-grade glioma (HGG) (P) with solitary brain metastasis (SBM) (C) by creating a combination of relative cerebral blood volume (rCBV) (O) and fractional anisotropy (FA) (O) in patients with intracerebral tumors.

Conclusion: Combining rCBV and FA measurements in the peritumoral region and FA in the intratumoral region increase the accuracy of MRI examination to differentiate between HGG and SBM patients effectively. Confidence in the accuracy of our results may be influenced by major interstudy heterogeneity. Whereas the $I2$ for the rCBV in the intratumoral subgroup was 80%, $I2$ for the rCBV in the peritumoral subgroup was 39%, and $I2$ for the FA in the intratumoral subgroup was 69%, and $I2$ for the FA in the peritumoral subgroup was 74%. The predefined accurate search criteria, and precise selection and evaluation of methodological quality for included studies, strengthen this studyOur study has no funder, no conflict of interest, and followed an established PROSPERO protocol (ID: CRD42021279106).

36   ## Diagnostic Accuracy of MRI Techniques for Treatment Response Evaluation in Patients with Brain Metastasis: a Systematic Review and Meta-Analysis

Abstract

Background: Treatment response assessment in patients with brain metastasis uses contrast enhanced T1-weighted MRI. Advanced MRI techniques have been studied, but the diagnostic accuracy is not well known. Therefore, we performed a metaanalysis to assess the diagnostic accuracy of the currently available MRI techniques for treatment response.

Conclusion: A combination of techniques shows the highest diagnostic accuracy differentiating tumor progression from treatment induced abnormalities. External validation of imaging results is important to better define the reliability of imaging results with the different techniques.

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37   ## Can Magnetic Resonance Imaging Enhance the Assessment of Potential New Treatments for Cognitive Impairment in Mood Disorders? A Systematic Review and Position Paper by the International Society for Bipolar Disorders Targeting Cognition Task Force

Abstract

Background: Developing treatments for cognitive impairment is key to improving the functioning of people with mood disorders. Neuroimaging may assist in identifying brain-based efficacy markers. This systematic review and position paper by the International Society for Bipolar Disorders Targeting Cognition Task Force examines the evidence from neuroimaging studies of pro-cognitive interventions.

Conclusions: Modulation of CCN and DMN activity is a putative efficacy biomarker. Methodological recommendations are to pre-declare intended analyses and use task-based fMRI, paradigms probing the CCN, longitudinal assessments, mock scanning, and out-of-scanner tests.

Resources. Day 3

Neuroimaging and Dementias

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38 ## Machine Learning Imaging Applications in the Differentiation of True Tumour Progression from Treatment-Related Effects in Brain Tumours: a Systematic Review and Meta-Analysis

Abstract

Introduction: Chemotherapy and radiotherapy can produce treatment-related effects, which may mimic tumour progression. Advances in Artificial Intelligence (AI) offer the potential to provide a more consistent approach of diagnosis with improved accuracy. The aim of this study was to determine the efficacy of machine learning models to differentiate treatment-related effects (TRE), consisting of pseudoprogression (PsP) and radiation necrosis (RN), and true tumour progression (TTP).

Conclusion: TRE can be distinguished from TTP with good performance using machine learning-based imaging models. There remain issues with the quality of articles and the integration of models into clinical practice. Future studies should focus on the external validation of models and utilize standardized criteria such as CLAIM to allow for consistency in reporting.

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39 ## Systematic Review and Meta-Analysis of Diagnostic Test Accuracy (DTA) Studies: the Role of Cerebral Perfusion Imaging in Prognosis Evaluation of Mild Cognitive Impairment

Abstract

Background: The application value of cerebral perfusion imaging, such as fluorodeoxyglucose-positron-emission computed tomography (FDG-PET), single-photon emission computed tomography (SPECT), and structural magnetic resonance imaging (MRI), in the prognostic assessment of mild cognitive impairment (MCI) remains unclear. Thus, it was the focus of this meta-analysis, which aimed to provide a theoretical basis for early diagnosis of neurological diseases.

Discussion: Cerebral perfusion imaging has good prognostic value for patients with MCI, and FDG-PET imaging has better predictive ability of the prognosis for patients with MCI.

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40 ## Diagnostic Yield of Diffusion-Weighted Brain Magnetic Resonance Imaging in Patients with Transient Global Amnesia: a Systematic Review and Meta-Analysis

Abstract

Objective: To investigate the diagnostic yield of diffusion-weighted imaging (DWI) in patients with transient global amnesia (TGA) and identify significant parameters affecting diagnostic yield.

Conclusion: The pooled diagnostic yield of DWI in TGA patients was 39%. DWI obtained with a slice thickness ≤ 3 mm or an interval between symptom onset and DWI of > 24 to 96 hours could increase the diagnostic yield.

41 ## The Applications of Focused Ultrasound (FUS) in Alzheimer's Disease Treatment: a Systematic Review on Both Animal and Human Studies

Abstract

Alzheimer's disease (AD) affects the basic ability to function and has imposed an immense burden on the community and health care system. Focused ultrasound (FUS) has recently been proposed as a novel noninvasive therapeutic approach for AD. However, systematic reviews on the FUS application in AD treatment have not been forthcoming. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria to summarize the techniques associated with safety and efficacy, as well as possible underlying mechanisms of FUS effects on AD in animal and human studies. Animal studies demonstrated FUS with microbubbles (FUS-MB) induced blood-brain-barrier (BBB) opening that could facilitate various therapeutic agents entering the brain. Repeated FUS-MB and FUS stimulation can relieve AD pathology and improve cognitive and memory function. Human studies showed repeated FUS-MB are well tolerated with few adverse events and FUS stimulation could enhance local perfusion and neural function, which correlated with cognitive improvement. We conclude that FUS is a feasible and safe therapeutic and drug delivery strategy for AD. However, FUS treatment on humans is still in the early stages and requires further optimization and standardization.

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42 ## Technical and Clinical Validation of Commercial Automated Volumetric MRI Tools for Dementia Diagnosis - a Systematic Review

Abstract

Developments in neuroradiological MRI analysis offer promise in enhancing objectivity and consistency in dementia diagnosis through the use of quantitative volumetric reporting tools (QReports). Translation into clinical settings should follow a structured framework of development, including technical and clinical validation steps. However, published technical and clinical validation of the available commercial/proprietary tools is not always easy to find and pathways for successful integration into the clinical workflow are varied. The quantitative neuroradiology initiative (QNI) framework highlights six necessary steps for the development, validation and integration of quantitative tools in the clinic. In this paper, we reviewed the published evidence regarding regulatory-approved QReports for use in the memory clinic and to what extent this evidence fulfils the steps of the QNI framework. We summarize unbiased technical details of available products in order to increase the transparency of evidence and present the range of reporting tools on the market. Our intention is to assist neuroradiologists in making informed decisions regarding the adoption of these methods in the clinic. For the 17 products identified, 11 companies have published some form of technical validation on their methods, but only 4 have published clinical validation of their QReports in a dementia population. Upon systematically reviewing the published evidence for regulatory-approved QReports in dementia, we concluded that there is a significant evidence gap in the literature regarding clinical validation, workflow integration and in-use evaluation of these tools in dementia MRI diagnosis.

(43) Effects of Chronic Pain Treatment on Altered Functional and Metabolic Activities in the Brain: a Systematic Review and Meta-Analysis of Functional Neuroimaging Studies

Abstract

Previous studies have identified altered brain changes in chronic pain patients, however, it remains unclear whether these changes are reversible. We summarized the neural and molecular changes in patients with chronic pain and employed a meta-analysis approach to quantify the changes. We included 75 studies and 11 of these 75 studies were included in the activation likelihood estimation (ALE) analysis. In the 62 functional magnetic resonance imaging (fMRI) studies, the primary somatosensory and motor cortex (SI and MI), thalamus, insula, and anterior cingulate cortex (ACC) showed significantly decreased activity after the treatments compared to baseline. In the 13 positron emission tomography (PET) studies, the SI, MI, thalamus, and insula showed significantly increased glucose uptake, blood flow, and opioid-receptor binding potentials after the treatments compared to baseline. A meta-analysis of fMRI studies in patients with chronic pain, during pain-related tasks, showed a significant deactivation likelihood cluster in the left medial posterior thalamus. Further studies are warranted to understand brain reorganization in patients with chronic pain compared to the normal state, in terms of its relationship with symptom reduction and baseline conditions.

(44) Prenatal Ultrasound Diagnosis of Biometric changes in the Brain of Growth Restricted Fetuses. A Systematic Review of Literature

Abstract

Fetal growth restriction (FGR) occurs when the fetus does not reach its intrauterine potential for growth and development as a result of compromise in placental function. It is a condition that affects 5 to 10% of pregnancies and is the second most common cause of perinatal morbidity and mortality. Children born with FGR are at risk of impaired neurological and cognitive development and cardiovascular or endocrine diseases in adulthood. The purpose of the present revision is to perform a literature search for evidence on the detection and assessment by ultrasound of brain injury linked to FGR during fetal life. Using a systematic approach and quantitative evaluation as study methodology, we reviewed ultrasound studies of the fetal brain structure of growth-restricted fetuses with objective quality measures. A total of eight studies were identified. High quality studies were identified for measurement of brain volumes; corpus callosum; brain fissure depth measurements, and cavum septi pellucidi width measurement. A low-quality study was available for transverse cerebellar diameter measurement in FGR. Further prospective randomized studies are needed to understand the changes that occur in the brain of fetuses with restricted growth, as well as their correlation with the changes in cognitive development observed.

45 **Defining Functional Brain Networks Underlying Obsessive-Compulsive Disorder (OCD) Using Treatment-Induced Neuroimaging Changes: a Systematic Review of The Literature**

Abstract

Approximately 2%-3% of the population suffers from obsessive-compulsive disorder (OCD). Several brain regions have been implicated in the pathophysiology of OCD, but their various contributions remain unclear. We examined changes in structural and functional neuroimaging before and after a variety of therapeutic interventions as an index into identifying the underlying networks involved. We identified 64 studies from 1990 to 2020 comparing pretreatment and post-treatment imaging of patients with OCD, including metabolic and perfusion, neurochemical, structural, functional and connectivity-based modalities. Treatment class included pharmacotherapy, cognitive-behavioural therapy/exposure and response prevention, stereotactic lesions, deep brain stimulation and transcranial magnetic stimulation. Changes in several brain regions are consistent and correspond with treatment response despite the heterogeneity in treatments and neuroimaging modalities. Most notable are decreases in metabolism and perfusion of the caudate, anterior cingulate cortex, thalamus and regions of prefrontal cortex (PFC) including the orbitofrontal cortex (OFC), dorsolateral PFC (DLPFC), ventromedial PFC (VMPFC) and ventrolateral PFC (VLPFC). Modulating activity within regions of the cortico-striato-thalamo-cortical system may be a common therapeutic mechanism across treatments. We identify future needs and current knowledge gaps that can be mitigated by implementing integrative methods. Future studies should incorporate a systematic, analytical approach to testing objective correlates of treatment response to better understand neurophysiological mechanisms of dysfunction.