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Research Article

Is MRI More Informative for Diagnosis of Autism Compared with No Brain Imaging?

Muhamad Khadrawi *[1], Youssef El Joueid[1], Maia Alkhidze[1,2]

1.Department of Medicine, School of Health Sciences, University of Georgia, Tbilisi, Georgia

2. Institute of Neurology and Neuropsychology, Tbilisi, Georgia

***Correspondence to:** Muhamad Khadrawi, Department of Medicine, School of Health Sciences, University of Georgia, Tbilisi, Georgia.

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Abstract

Objective: *To determine whether MRI is more informative for the diagnosis of Autism compared with no brain imaging.*

Methodology: *The PubMed electronic database was searched to extract relevant and appropriate studies. A lot of literature was explored, and six studies were included in this review. These studies were chosen after the proper exclusion, and inclusion criteria were applied. The included studies were then critically reviewed and analysed to extract the most important and valuable knowledge to produce desired results.*

Results: *The studies that we have discussed so far have shown that there are a vast literature and evidence-based research available that supports our research topic that MRI is an informative and authentic diagnosis of Autism compared to no brain imaging. Majority of literature is available, which helps that MRI is a useful diagnostic method to rule out Autism.*

Conclusion: *From the results of recent studies and literature, it is thus concluded that brain imaging such as MRI is increasingly used in the diagnosis of ASD (Autism spectrum disorders) and has also been confirmed by published studies.*

Introduction

Social communication disorders and limited and repeated behaviours are behaviorally described by autism spectrum disorder (ASD). While these core behavioural domains provide the behavioural phenotype of ASD with a loose structure, the constellation and severity of behavioural symptoms and associated characteristics shown by affected individuals vary greatly. The increasingly complex genetics correlated with Autism, an emerging environment that includes de novo and inherited causative determinants and numerous unique and standard variants, reflect this phenotypic heterogeneity. The uncertainty and heterogeneity of ASD's external presentation and its genetic architecture recognizes that it is fundamentally a neurodevelopmental condition.

While identified by the existence or absence of unique behavioural markers, Autism is biologically dependent and results from a changed brain developmental pathway that starts in ontogeny very early. **(**Wolff, Jacob, & Elison, 2018**)**.

After the MRI's arrival, the neuro-anatomy of autism spectrum disorders **(**ASD**)** has become better acknowledged. MRI studies determined that the signs of the brain's overall increased volume and early speedy overgrowth of the brain in affected people approved primary verdicts of an above-average head circumference. Consistent anomalies in grey and white matter of cortical volume in ASDs were unveiled in this study. **(**Stigler, McDonald, Anand, Saykin, & McDougle, 2011**)**. Recently, the MRI with resting-state function has been implemented to diagnose ASD, using blood-oxygenation-level-dependent **(**BOLD**)** signals as a neurophysiological index to measure the brain's activity. BOLD signals may be used as robust and non-invasive interventions, susceptible to natural and intrinsic neural activity, to examine neuropathological substrates of many neurological and psychological conditions at the entire brain system level. **(**Zhao, Zhang, Rekik, An, & Shen, 2018**)**.

A relatively small developmental window in which ASD unfolds provides researchers with the strength to separate developmental events driving to its onset. Recently Autism's emergence dodged direct research. Approaches to understanding how early in life, the condition emerged are primarily based on retrospective strategies or inferences based on newly diagnosed infants and preschoolers; and conjectures based on older children or adults' results. In their ability to capture the specific and sometimes intricate experiences that co-occurred with a diagnosis, these methods advanced awareness but were ultimately limited. Concerning the brain, retrospective strategies have been mainly limited to head circumference records. **(**Wolff et al., 2018**)**.

In identifying the gross anatomy of Autism, much has been done. However, structural imaging research in Autism has yet to fulfil its original goal of identifying developmental trajectories about each other for TVB and individual structures, consistent with a model of neural systems. Within the three decades during which disruptions in brain growth in Autism are unfolding, these trajectories must also be determined. Suggestions for premature ageing expand the time of significance over the life cycle. Above all, structural imaging has not yet attained the goal of accounting for the heterogeneity so characteristic of Autism, nor has it exploited the richness of imaging genetics that would enrich the awareness of people with ASD and strengthen their treatment. **(**Williams & Minshew, 2007**)**.

Methods

Using an electronic database, the necessary data and studies included in this research paper were searched and extracted. To obtain beneficial and appropriate research studies, the search engine PubMed was used. We needed to choose reasonable mesh terms or keywords when we initiated our data search, which could help us find the most appropriate and relevant articles. Autism, neuroimaging and MRI were the keywords we used to find the relevant literature on the research topic. Many studies were found from these keywords; only the mesh term "Autism and MRI" provided us with 1987 results on PubMed. However, since we had to follow the articles that could fulfil our research criteria, many studies that did not meet inclusion criteria were excluded after removing the research. Once the duplicates were removed, and irrelevant studies were roughly eliminated, an appropriate inclusion and exclusion criterion was designed and implemented to reduce our data findings.

Inclusion Criteria

- The studies which include human participants
- Studies including participants diagnosed with Autism Spectrum Disorders **(**ASD**)** clinically
- Studies in which Autism was diagnosed using MRI.
- English language articles
- Full-text articles
- Articles including at least two keywords.

Any article that does not meet the inclusion criteria or has been written and published in a non-English language has been excluded. Studies that do not include the features from MRI were also excluded from the study.

Six articles were finally included in this research paper after going through this process of identifying, exclusion, and selecting relevant articles. One systematic review was included in these six papers, and the remainder of the five papers consisted of one cross-sectional study, one experimental study, one retrospective study, and two case-control studies. These studies have been thoroughly checked and reviewed, their results have been critically evaluated, and their findings have been systematically assessed.

Once these studies have been critically reviewed and verified, their relevant information has been taken out and used in a research paper. These studies have provided us with in-depth knowledge and relevant data, which was essential to produce a specific result on the subject of our review.

Results

The studies that we have discussed so far have shown that there are a vast literature and evidence-based research available that supports our research topic that MRI is an informative and authentic diagnosis of Autism compared to no brain imaging.

Recent research using MRI to identify brain changes associated with ASD are compiled in this study, highlighting many common findings through reviews. Innovations in neuroimaging technology in autism spectrum disorders **(**ASD**)** are occurring exponentially, and over the past five years, the level of neuroimaging research has risen significantly. With the introduction of magnetic resonance imaging, the neurobiology of autism spectrum disorders **(**ASDs**)** has been better known **(**MRI**)**. These findings provide evidence of under-connectivity essential to the fundamental impairments associated with ASDs in dispersed cortical networks. As a whole, significant insights into the neurobiology of ASDs were created by structural and functional MRI research. Critical information related to this phase has been provided by neuroimaging studies based on this development stage, including possible mechanism involved in the pathogenesis of the condition and providing the possibility for prodromal or presymptomatic risk prediction.

Discussion

Research by Janet E. Lainhart et al. **(**2015**)** concluded that in-vivo imaging studies in ASD have the capacity over the lifetime to discover accurate and replicable clinical-pathological interactions. These results will help the research progress from identifying ASD as a psychiatric condition to understanding ASD as a general expression of several pathological processes that are at least quite distinct from neurodevelopmental diseases. There is an indication of abnormalities in the posterior lobes and posterior brain networks in ASD in the first two years of life and impairment in primary cortical areas, including in young children. This research highlights a collection of recent developments from over 200 original research publications in the past 12 months. **(**Lainhart, 2015**)**.

M. In 2018, Pagnozzi conducted a systemic study showing that producing comprehensive ASD brain imaging genetic markers using structured magnetic resonance imaging **(**MRI**)** is a crucial component in therapy diagnosis and customization, particularly young age when therapies can have the most significant influence. Besides, a range of conflicting results have been reported, along with the longitudinal developing brain volume trajectory, and also volume differences between both the ASD and TDC cohorts in the hippocampus, amygdala, basal ganglia and thalamus, which can either indicate the heterogeneity of ASD or the implicit effect of ASD on these regions. In contrast, a variety of conflicting results have been reported, such as the longitudinal developmental brain volume trajectory, and also volume differences between the ASD and TDC cohorts in the hippocampus, amygdala, basal ganglia and thalamus, which can either indicate the heterogeneity of ASD or the slight effect of ASD on those areas. Future studies may explore the use of more comprehensive datasets to illustrate the conflicting results in the literature, either through integrating data from various locations or using open datasets or using 3T scanning to identify more noticeable brain changes. In comparison, research should aim to implement a rigorous validity plan to ensure the generalization of the analysis and exploit 3T scanning's enhanced spatial resolution to detect subtle ASD-related brain changes. **(**Pagnozzi, Conti, Calderoni, Fripp, & Rose, 2018**)**.

A review by A. In 2011, Stigler stated that the neurobiology of autism spectrum disorders **(**ASDs**)** had been increasingly recognized after the emergence of magnetic resonance imaging **(**MRI**)**. The advancement of operational MRI techniques has provided a better understanding of the brain pathways of ASD, revealing regions of impaired cortical activation and aberrant cortical specialization. Such research has indicated underconnectivity in distributed cortical networks central to the central impairments associated with ASDs. In the default-mode network, mostly during the stable phase, anomalies were also identified.

All in all, functional and structural MRI study has developed important information into the neurophysiology of ASDs. Additional research is needed to restrict further the related cognitive basis of this cluster of abnormalities. **(**Stigler et al., 2011**)**.

A research was performed by Diane Williams et al. **(**2007**)**. It concluded that in the temporal regions, children and young people with Autism had an impairment developed in the interpretation and perception of progressively greater and that RI is significant in diagnosing ASD. This analysis focuses on the critical and specific contributions made to the comprehension of Autism through structural or functional imaging. This neurodevelopmental condition has an enormous influence on the brain and neurological functioning. The neuroscience of Autism focused on diffusion tensor imaging and monitoring techniques, is currently in

the process of the third phase of studies and emerging observations; voxel-based morphometry; MRS; longitudinal analysis of first-diagnosed pre-school children with ASD; already initiated or to begin research of newborn siblings of children with Autism; and massive, multi-site scanning, phenotype, and genotype. This study aimed to establish a cognitive, structural, functional, and hereditary accounting of behavioural diversity to relate cognitive and imaging findings to molecular and cellular histology and then to neurobiological, genetic, and epigenetic pathways of development. **(**Williams & Minshew, 2007**)**.

In 2018, Jason J. Wolff published research that illustrated a large and relatively limited risk window for the advancement of Autism. Essential increases in magnetic resonance imaging **(**MRI**)** studies based on ASD in childhood and adolescence have been seen in the last 15 years. This increase in the articles available is due to enhanced strategies for obtaining young children's MRI data. This study also offers resources to accurately detect vulnerability for the condition and treat before a time where Autism is traditionally identified. Nevertheless, we would be remiss in failing to understand that there is no simple, possibly the best course to Autism. Instead, numerous developmental processes take place in a specific diagnosis, and it is possible that explaining these trajectories would improve the specificity in which children are diagnosed and care given. **(**Wolff et al., 2018**)**.

In his study, Zhao et al. **(**2018**)** demonstrated that functional brain pathways generated from resting-state functional magnetic resonance imaging **(**rs-fMRI**)** had been commonly used for the diagnosis of Autism **(**ASD**)**. This can be easily noticed that all hemispheres and different lobes are dispersed between the discriminatory interactions and brain areas, suggesting the generalized distribution of functional defects across ASD patients' entire brains. Finally, this should be noticed that we have used a simplistic method of selecting features, so the feature selection may indeed contain obsolete details, which may affect the accuracy of our identification. The techniques for selecting differential characteristics and combination, therefore encourage further investigation, will be explored in our future research. **(**Zhao et al., 2018**)**.

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