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Review Article

A comprehensive review on role of magnetic resonance imaging in the precise measurement of corpus callosum

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ABSTRACT

Magnetic Resonance Imaging (MRI) has emerged as a powerful and non-invasive imaging technique, playing a pivotal role in neuroimaging research and clinical diagnosis. This comprehensive review explores the significance of MRI in the precise measurement of the corpus callosum, a key structure connecting the two hemispheres of the brain. The corpus callosum plays a crucial role in inter hemispheric communication and is implicated in various neurological and psychiatric disorders. The review begins by elucidating the anatomy and functions of the corpus callosum, emphasizing its importance in facilitating seamless communication between the cerebral hemispheres. Subsequently, the paper delves into the historical evolution of MRI techniques and how advancements have enhanced the visualization and measurement capabilities of the corpus callosum. A detailed examination of various MRI modalities, including structural MRI, diffusion tensor imaging (DTI), and functional MRI, is presented in the context of corpus callosum analysis. Structural MRI provides high-resolution images for accurate morphological assessments, while DTI offers insights into white matter microstructure and fiber tractography, allowing for a more comprehensive understanding of the corpus callosum's integrity. The review also highlights the role of MRI in investigating alterations in the corpus callosum associated with neurological disorders such as multiple sclerosis, epilepsy, and neurodevelopmental disorders. Additionally, the paper explores how functional MRI contributes to understanding the functional connectivity and inter hemispheric interactions mediated by the corpus callosum. Challenges and limitations in the measurement of the corpus callosum using MRI are discussed, including methodological considerations, image artifacts, and potential sources of variability. The review concludes by outlining future directions in corpus callosum imaging research, including the integration of advanced imaging techniques, artificial intelligence, and large-scale multi-center studies to enhance the precision and reliability of measurements.

In summary, this comprehensive review underscores the pivotal role of MRI in advancing our understanding of the corpus callosum, providing valuable insights into both normal brain function and pathological conditions. The continual evolution of MRI techniques holds promise for further refining the assessment of the corpus callosum, ultimately contributing to improved diagnostic accuracy and therapeutic interventions in neurological and psychiatric disorders.

1. Introduction

The brain's main interhemispheric commissure, the corpus callosum (CC), is made up of more than 200 million fibres that connect the cerebral hemispheres.[1–3] The main functions include maintaining memory, enhancing language

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and auditory skills, coordinating sensory fields, and arranging bimanual motor output. CC plays a major role in interhemispheric integration, which is essential for intelligence and creativity. Language proficiency in writing and alexia seems to be pertinent to the CC. Callosal pathologies have been associated with a wide range of diseases, such as neurofibromatosis, autism, multiple sclerosis, cerebrovascular problems, tumours, chemotherapy, and infection. The genu, body, spleenium, and rostrum make up the anatomical CC. While the other portions of the CC grow between 8 and 20 weeks of gestation, the rostrum develops about 18 to 20 weeks post conceptional age. The degree of fibre myelination is the main factor regulating CC size. The CC has a significant growth surge during the first one to four years of life following birth, and this expansion may last until the third decade.[4] Foetal corpus callosum growth and maturation are important indicators of healthy brain development. Since the corpus callosum is a part of the brain's highest order freshly growing mental network, measurements of it are essential for determining appropriate brain development and identifying physical changes. A comprehensive evaluation of the typical development of the human foetal corpus callosus is required in order to recognise and understand congenital brain abnormalities. Therefore, the prenatal diagnosis of partial or complete corpus callosum agenesis determines how the foetus will grow. Despite a wealth of information on the prenatal detection of anomalies in the corpus callosum, its typical in utero growth and growth are rarely documented. The advanced high-resolution MRI imaging technique of the foetal corpus callosum will facilitate the diagnosis of gestation anomalies earlier in pregnancy. Understanding the usual development pattern of the corpus callosum would certainly help in identifying anomalous growth, as Harreld indicates. The developing fetus's mental development can be estimated from the expanding corpus callosal. When callosal disorders begin to adversely affect the developing foetal brain is unknown. foetal neural abnormalities detected on prenatal ultrasound (USG) can be detected early using foetal magnetic resonance imaging (MRI). Foetal magnetic resonance imaging provides a detailed picture of normal brain development.[5] Thus, variations in the size of the corpus callosum have been linked to certain neurological disorders, such as Alzheimer's disease and bipolar affective disorder. T1 weighted magnetic resonance imaging offers the most efficient visualisation and assistance in estimating the thickness of various corpus callosum segments.[6]

2. Materials and Methods

This comprehensive review study was done at department of paramedical sciences, subharti medical college, swami Vivekanand subharti university, meerut, up, india. Article for review are taken from different research websites like

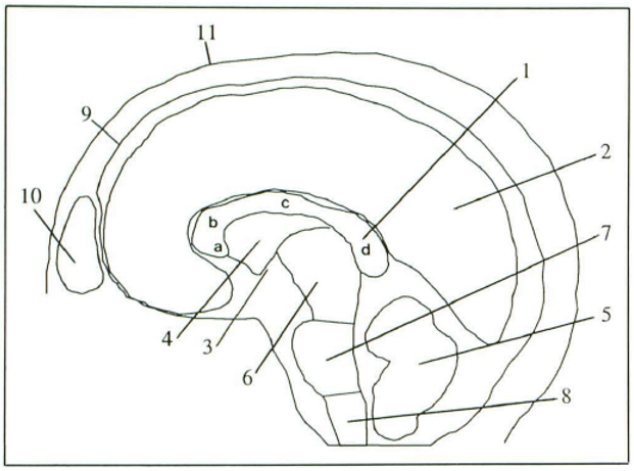

Figure 1: Graphic plot showing the digitized structures to be measured. 1=Corpus callosum with: a=rostrum, b=genu, c=trunk, d=splenium; 2=Telencephalon; 3=fornix; 4=septum pellucidum; 5=Cerebellum; 6=Mesencephalon; 7=pons; 8=medulla ablongata; 9=Inner cranial cavity; 10=sinus frontalis; and 11= outer skull contour.

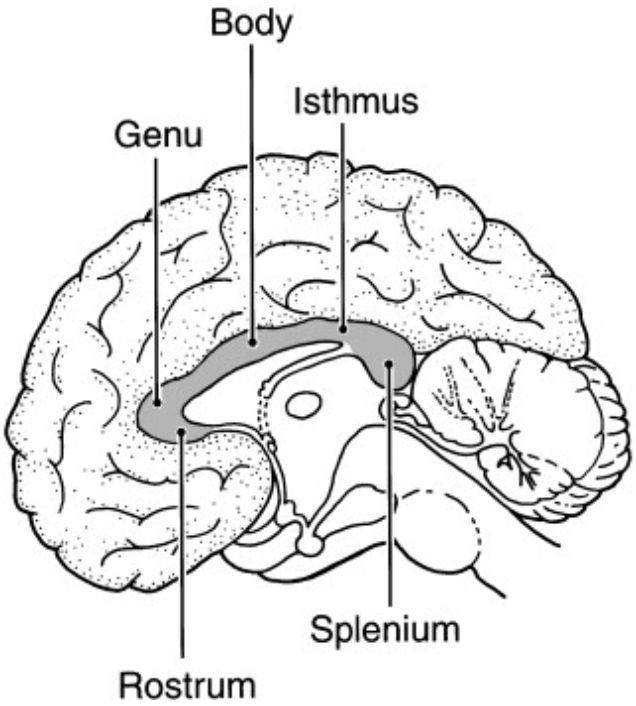

Figure 2: Anatomy of corpus callosum

web of science, scopus, pubmed and different journal websites. After studying the different article, they were used MRI for measurement of corpus callosum with common brain sequences. MRI brain patient was used for sample collection/ data collection. They were used convenient sampling for their study. They measured corpus callosum length like AP length, Genu length, Body length, Splenium length.

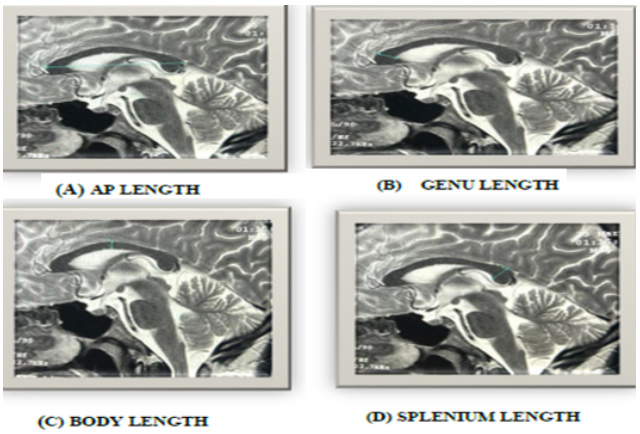

Figure 3: Measurement taken of corpus callosum

3. Results and Discussion

In this comprehensive review on role of magnetic resonance imaging in the precise measurement of corpus callosum was done at department of paramedical sciences, subharti medical college, swami Vivekanand subharti university, meerut, uttar Pradesh west, india. This review objective is to measure the size of corpus callosum.

Weis S., et.al; (1993)[7] **:** This study aims to establish a reference range for the corpus callosum in neonates through ultrasound imaging and to develop a clinically feasible screening method for congenital abnormalities. Conducted between January 2015 and July 2016, the observational study utilized 2D and 3D ultrasound evaluations, employing virtual organ computer-aided analysis for volume calculation. Parameters measured included rostrum thickness, genu thickness, body thickness, splenium thickness, anterior-posterior distance, true length, and volume of the corpus callosum. Inter- and intra-observer agreement was assessed, with corrected gestational age ranging from 38+0 to 47+2 weeks. The least-mean-square method created growth curves for each parameter. Complete data sets from 317 neonates, aged 0 to 28 days, were analyzed, providing reference values from the 1st to 99th percentiles. All parameters exhibited nonlinear growth trends with age, and excellent inter- and intra-observer agreement was observed for both 2D and 3D parameters. The study suggests that computer-assisted techniques enhance corpus callosum volume assessment, and the 2D and 3D ultrasound data for seven morphologic parameters may aid in identifying corpus callosum anomalies within a large neonatal population.

Rajapakse, J.; et. al; (1996)[8] This study introduces a novel technique for the precise quantification of the mid-sagittal size and shape of the corpus callosum (CC) based on magnetic resonance brain scans. The method involves measuring distances to the ventral and dorsal boundaries of small CC sectors from a reference point, enabling the computation of size and shape parameters for the CC and its subdivisions. The reliability of the technique was assessed through intrarater and interrater interclass correlation coefficients, yielding values ranging from 0.88 to 0.99 for area measurements. High correlations were observed between these automated measures and those obtained through pixel counting. The study examined the corpus callosa of 104 right-handed healthy children and adolescents (57 male and 47 female) aged 4-18. Results revealed notable growth in the splenium and isthmus, with concurrent changes in midbody regions. The area and perimeter of these regions increased, shapes became more compact, and boundaries became more regular with age. Additionally, the length and curvature at the anterior and posterior regions of the CC exhibited more rapid increases in males than in females. These consistent and statistically significant findings underscore the reliability and sensitivity of the proposed method in capturing developmental changes in the corpus callosum.

Dorion A., et.al; (2001)[9] **:** Since the initial postmortem report highlighting sex-related differences in the human corpus callosum, numerous studies on this subject have been conducted, yielding conflicting results. Rather than assessing the existence and magnitude of sex variations, this review aims to analyze methodological differences across Magnetic Resonance Imaging studies investigating sexual dimorphism in corpus callosum size. Methodological challenges emerge at various stages, including sampling, imaging techniques, and measurements. Notably, callosal area means from nine reported studies exhibit significant differences. Statistical analyses support the hypothesis that methodological variations contribute to these discrepancies. To resolve the question of genuine sexual dimorphism in the corpus callosum and its subregions, a standardized methodology for investigating sex-related differences in callosal morphology is deemed essential. This review emphasizes the need for a common approach to facilitate more accurate and comparable assessments across studies.

Chiara N., et.al; (2004)[10]**:** Thinning of the corpus callosum (CC) is a common observation in individuals born very preterm, and such CC damage during neurodevelopment may be linked to suboptimal neuropsychological performance. This study aimed to investigate potential CC pathology in adolescents aged 14–15 years who were born very preterm and to examine the

Table 1:

S.No.	Reference	Country	Methodology	Total No. of Patients Data	Approach	Part Studied
1.	Weis S. et.al; (1993)[7]	Austria	prospective	100	Age and gender	MRI Brain
2.	Rajapakse J. et.al; (1996)[8]	USA	Retrospective	104	Age and gender	MRI Brain
3.	Dorion A. et.al; (2001)[9]	France	prospective	100	Age and gender	MRI Brain
4.	Chiara N. et.al; (2004)[10]	UK	prospective	72	Age and gender	MRI Brain
5.	Britt J. et.al; (2008)[11]	Netherlands	prospective	100	Age and gender	MRI Brain
6.	Rizzo G. et.al; (2011)[12]	Tibernia	Retrospective	100	Age and gender	MRI Brain
7.	Mohammad R. et.al; (2011)[13]	Iran	Retrospective	100	Age and gender	MRI Brain
8.	Garel C. et.al; (2011)[14]	France	Retrospective	622	Age and gender	MRI Brain
9.	Gao Y. et.al; (2018)[15]	China	Retrospective	100	Age and gender	MRI Brain
10.	Kamal N. et.al; (2019)[16]	Turkey	Retrospective	436	Age and gender	MRI Brain
11.	Ping J. et.al; (2020)[17]	China	Retrospective	119	Age and gender	MRI Brain
12.	Gnawal S. et.al; (2021)[18]	Nepal	prospective	80	Age and gender	MRI Brain
13.	Berman S. et.al; (2021)[19]	Isrel	prospective	92	Age and gender	MRI Brain
14.	Bayer O. et.al; (2021)[20]	Turkey	prospective	240	Age and gender	MRI Brain

correlation between CC areas and verbal skills. Seventy-two individuals born before 33 weeks of gestation and 51 age- and sex-matched full-term controls underwent structural MRI and neuropsychological assessments. Adjusting for total white matter volume, the total CC area in very preterm adolescents was 7.5% smaller than in controls (P = 0.015). Notably, the absolute size of callosal subregions varied between preterm and full-term adolescents, with a 14.7% reduction in the posterior (P < 0.0001) and an 11.6% reduction in the mid-posterior CC quarters (P = 0.029) for preterm individuals. Among very preterm boys, those with a history of periventricular hemorrhage and ventricular dilatation in the neonatal period exhibited the most significant decrease in CC area. Furthermore, in very preterm boys exclusively, verbal IQ and verbal fluency scores were positively linked to total mid-sagittal CC size and mid-posterior surface area. These findings suggest that very preterm birth has adverse effects on CC development, particularly in its posterior quarter, leading to impaired verbal skills in boys.

Britt J.; et.al;(2008)[11]**:** Magnetic resonance imaging (MRI) studies have played a crucial role in identifying patterns of cerebral injury associated with neonatal encephalopathy (NE). This study aimed to investigate whether a diminished corpus callosum (CC) could account for the motor performance differences observed in school-age children with NE compared to controls. The frontal, middle, and posterior areas of the CC were measured in 61 children aged 9–10 years with NE and 47 control participants. Motor performance was assessed using the Movement Assessment Battery for Children (M-ABC). Linear regression was employed to examine whether variations in M-ABC scores between children with NE and controls could be attributed to CC size. The results revealed that 11 out of 30 children with NE type I and 19 out of 36 children with NE type II exhibited generalized or focal thinning in the CC, compared to 8 out of 49 controls. Specifically, children with NE type II showed significantly smaller middle and posterior parts, as well as total areas, of the CC. Furthermore, children with NE scored significantly lower on the M-ABC compared to controls. The reduction in the size of the posterior part of the CC partially accounted for the observed mean differences in M-ABC scores. In conclusion, children with NE exhibit poorer motor skills than controls, and a smaller size of the CC, particularly in the posterior region, contributes to these differences.

Rizzo G.; et.al; (2011)[12] This study aims to analyze the alterations in the human corpus callosum and MR midsagittal brain structures that occur during the normal aging process. We developed a morphometric evaluation strategy for quantifying these brain structures on MR scans, utilizing a computerized measuring program capable of acquiring over 100 one- and two-dimensional parameters. The focus was on assessing changes in the anterior parts of the corpus callosum, including the genu and anterior sections of the trunk, with implications for alterations in frontal and temporal interhemispheric fiber systems during normal aging. Additionally, modifications in callosal thickness and width of the anterior corpus callosum were examined. Methods: Our study revealed significant decreases in the anterior parts of the corpus callosum during normal aging, indicating potential changes

in frontotemporal interhemispheric fiber systems. Further variations were observed in callosal thickness and width in the anterior regions. Additionally, the profile area of the telencephalon displayed a significant reduction with aging, and age-specific changes were identified in the size of the mesencephalon. Results: The proposed computer program demonstrated its efficacy as a robust and reliable tool for obtaining objective and reproducible quantitative data on the corpus callosum and midsagittal brain structures. These findings highlight specific age-related changes in the corpus callosum, suggesting alterations in frontotemporal interhemispheric fiber systems during the normal aging process.

Mohammad R.; et.al;(2011)[13]**:** The morphometric measurements of the corpus callosum (CC) play a crucial role in establishing normative values considering sex and age. This study aimed to measure the CC size and identify gender- and age-related differences in individuals from the northern region of Iran. Methods: Magnetic resonance imaging (MRI) was utilized to measure the size of the CC on the midsagittal section in 100 normal subjects (45 males, 55 females) at the Kowsar MRI Center in Gorgan, Northern Iran. Various dimensions, including longitudinal and vertical dimensions of the CC, longitudinal and vertical lengths of the brain, and the lengths of the genu and splenium, were quantified. Data analysis involved student's unpaired t-test, ANOVA, and regression analysis. Results: While the anteroposterior length and vertical dimension of the CC, as well as the lengths of the genu and splenium, were larger in males compared to females, these differences were not statistically significant. However, the anteroposterior and vertical lengths of the brain were significantly larger in males ($P < 0.05$). The length of the CC exhibited an age-related increase, and regression equations were derived for predicting age based on CC length. Furthermore, a positive and significant correlation was observed between the anteroposterior length of the CC and the length of the brain, as well as the vertical dimension of the CC. Conclusion: This study demonstrated that various parameters of the CC exhibit variations in comparison to values documented in Caucasian, Indian, and Japanese populations. The findings contribute to the establishment of normative values for CC morphometry in the northern Iranian population, considering gender and age factors.

Garel C. et.al; (2011)[14]**:** Limited accessible data on corpus callosum (CC) biometry in children for practical use prompted this study to present reference biometry of the CC in a large cohort of children using MR imaging. Methods: Cerebral MR imaging studies were retrospectively selected from children with normal examination findings. Exclusions comprised children born preterm and those with or at risk of cerebral malformations. Various parameters, including frontal opening distance (FOD), anteroposterior diameter (APD), length of the CC (LCC), genu thickness (GT), body thickness (BT), isthmus thickness (IT), splenium thickness (ST), and the splenium-to-total CC ratio (S/T), were measured. The study included 622 children (320 boys, 302 girls) aged 1 day to 15 years. Normal values (from the 3rd to 97th percentile) were established for each parameter. Growth patterns were analyzed, and inter- and intra-observer agreement, as well as sex effects, were evaluated. Results: Rapid growth of all parameters was observed up to 3 years of age, followed by slower (FOD, APD, LCC, GT, and ST) or absent (S/T) growth. BT and IT completed growth by 7–8 years, while CC modeling (IT/ST) concluded by 3 years. FOD was larger in boys from the age of 1 year (statistically significant), while other parameters did not show any sex effect. Inter- and intra-observer agreement was excellent for all parameters, except for IT.

This study provides easily applicable and reproducible MR imaging biometry data of the CC in children, offering reference values and growth patterns for each parameter, thus contributing to practical clinical use.

Gao Y., et.al;(2018)[15]**:** This study aims to establish a reference range for the corpus callosum using ultrasound imaging in neonates and to develop a clinically feasible screening method for congenital abnormalities of the corpus callosum. Methods: An observational study was conducted from January 2015 to July 2016, involving 2D and 3D ultrasound evaluations. Virtual organ computer-aided analysis was employed for the volume calculation of the corpus callosum. Various parameters, including rostrum thickness, genu thickness, body thickness, splenium thickness, anterior-posterior distance, true length of the corpus callosum, and the volume of the corpus callosum, were measured. Inter- and intra-observer agreement was assessed. Neonates with a corrected gestational age between 38+0 and 47+2 weeks were included. The least-mean-square method was applied to create growth curves for each parameter. Complete data sets from 317 neonates, aged 0 to 28 days, were analyzed, providing reference values from the 1st to 99th percentiles. Results: All parameters exhibited a nonlinear growth trend with age, and inter- and intra-observer agreement was excellent for both 2D and 3D parameters. The study suggests that computer techniques can enhance the volume assessment of the corpus callosum. The 2D and 3D ultrasound data, comprising seven morphologic parameters, have the potential to facilitate the identification of corpus callosum anomalies within a large population. Conclusion: This research contributes to establishing reference values and a screening method for corpus callosum abnormalities in neonates, utilizing 2D and 3D ultrasound imaging with computer-aided analysis. The findings support the potential clinical applicability of these techniques for early detection and intervention in congenital corpus callosum anomalies.

Kamal N., et.al;(2019)[16]**:** The aim of this study was to investigate the potential relationship between morphometric measurements of the corpus callosum (CC), age, and gender characteristics using MR images. A retrospective review of medical data and MR examinations was conducted on 436 consecutive subjects. Methods: CC thickness from five different sites, splenium length, height, total length of the CC, and the splenium index (SI) were measured utilizing a mid-sagittal T1-weighted sequence. These measurements were then analyzed in relation to age and gender characteristics. Statistical comparisons were performed to assess potential correlations. Results: A weak but statistically significant negative correlation was identified between age and the thicknesses of the genu and all body portions of the CC ($P \leq 0.001$ for all). The correlation coefficients were -0.32 for genu, -0.317 for B1, -0.328 for B2, -0.328 for B2, and -0.194 for B3 and B4. Additionally, a weak but statistically significant positive correlation emerged between age and the lengths of the CC and splenium ($P \leq 0.022$ for both). Specifically, the correlation coefficients were 0.112 for CC length and 0.11 for splenium length. The second part of the body (B2) demonstrated greater thickness in females ($P = 0.014$). Conversely, CC and splenium lengths were found to be greater in males compared to females ($P = 0.029$ for both). Conclusion: This comprehensive MRI study revealed age-related variations in CC thickness and length, as well as gender-specific differences in certain CC measurements. The findings contribute to a better understanding of morphometric characteristics and their associations in the corpus callosum across different age groups and genders.

Ping, J**.,** et.al;(2020)[17]: The primary objective of this study was to explore the correlation between the corpus callosum area (CCa) and the extent of cerebral atrophy in individuals with cerebral atrophy. A total of 119 patients diagnosed with brain atrophy were categorized based on the severity of their condition. Measurements of the median sagittal CCa and intracranial area (ICa) were obtained, and the corpus callosum to intracranial area ratio (CCa-ICa ratio) was calculated. The obtained data were subjected to ANOVA for statistical analysis.

The results revealed a significant reduction in CCa among patients with cerebral atrophy. Furthermore, a positive correlation was identified between the degree of cerebral atrophy and the extent of CCa reduction. The diminished CCa and the CCa-ICa ratio in the median sagittal plane were identified as potentially valuable reference indicators for diagnosing and grading brain atrophy in clinical settings. This study's findings underscore the potential clinical utility of assessing CCa parameters to aid in the diagnosis and grading of cerebral atrophy.

Gnawal S., et.al;(2021)[18]**:** Corpus callosum (CC) serves as the primary fiber tract connecting the right and left hemispheres, facilitating crucial information integration. This cross-sectional quantitative study utilized magnetic resonance imaging (MRI) to investigate CC dimensions in 80 cases with normal MRI head scans over a two-month period. T1-weighted sagittal spin-echo images with a 6 mm slice thickness were analyzed, measuring the length and thickness of the corpus callosum. Data analysis, conducted using SPSS ver.20 software, involved frequency, percentages, and bar diagram representation. The study population (n=80) exhibited a mean corpus callosum (CC) length of 68.06 mm. The mean thickness of the genu, body, and splenium were 9.15 mm, 5.2 mm, and 9.08 mm, respectively, with an average thickness of 7.81 mm. Statistically significant differences in CC size across various age groups and between sexes were observed. The Pearson correlation coefficient between age and CC length was 0.48829, with a corresponding P-value of 0.0019, indicating a significant correlation. In conclusion, this study provides comprehensive insights into the dimensions of the corpus callosum, highlighting variations with age and sex. The statistically significant findings underscore the importance of considering these factors in the assessment of CC characteristics using MRI.

Berman, S.,et.al; (2021)[19]**:** In recent years, there has been a growing interest in correlating MRI measurements with the structural-biophysical properties of white matter fibers. This study focuses on utilizing MRI-based g-ratio estimation to observe g-ratio variance within the corpus callosum and assess sex and age-related differences. The g-ratio, a metric indicating the ratio of axon diameter to the total fiber diameter, is crucial for understanding white matter microstructure. To estimate the g-ratio, the study employed a model based on two white matter microstructure parameters: myelin volume fraction (MVF) and fiber volume fraction (FVF). FVF was derived from fractional anisotropy (FA), while MVF was estimated using lipid and macromolecular tissue volume (MTV) calculated from proton density. Comparisons with histological MVF measurements validated the accuracy of the model. The model was applied to a database of 92 subjects (44 males), aged 7 to 81, revealing that MTV provides a reliable estimation of MVF for g-ratio calculations. The obtained g-ratio values in the corpus callosum aligned with those observed in animals ex vivo and theoretical expectations. Importantly, the study found that g-ratio estimations remained relatively stable with age, in contrast to other MRI-measured tissue parameters. Furthermore, no significant sexual dimorphism in g-ratio with age was identified. In conclusion, the MRI-derived g-ratio, utilizing MTV, offers a straightforward and reliable in vivo measurement in humans. The stability of g-ratio estimations with age and the absence of significant sexual dimorphism provide valuable insights into white matter microstructure dynamics in the corpus callosum.

Bayar O., et.al;(2021)[20] **:** The corpus callosum (CC), a significant white matter structure, serves as the largest interhemispheric commissure connecting the brain hemispheres. Various factors, including congenital and acquired diseases, sex, age, and hand selection, can impact the morphology of the CC. This study aims to investigate the morphometric features of the CC concerning age and gender. Material and Methods: The thickness of all CC segments and the length of the long axis were measured using magnetic resonance imaging (MRI) from the midsagittal line, allowing monitoring of the septum pellucidum and massa intermedia. A total of 240 participants (120 males and 120 females) were categorized into four age groups: 0-2, 3-6, 7-11, and 12-17. The thickness of five CC segments (rostrum, genu, body, isthmus, splenium) and the anterior-posterior length of the CC were measured. Results: Thicknesses of four segments (genu, body, isthmus, and splenium, excluding the rostrum) and the length of the long axis of the CC demonstrated a significant increase with age in both genders. When evaluating all participants without gender discrimination, a significant increase in the thickness of all CC segments and the length of the long axis was observed. Conclusion: The obtained data from this study on the healthy pediatric population contribute to the understanding of normal morphometric changes in the CC. This knowledge will be valuable for distinguishing abnormal morphometric alterations resulting from congenital and acquired diseases.

In this comprehensive review on MRI role in corpus callosum measurement have reviewed on many research articles and the outcome about corpus callosum measurement have to variation in length of corpus callosum at different age groups between both sexes. We compare the reviewed outcome with some different authors study Weis S. et.al; (1993),[7] Rajapkase J. et.al; (1996),[8] Dorion A. et.al; (2001),[9] Chiara N. et.al; (2004),[10] Van K. et.al; (2008),[11] Rizzo G. et.al; (2011),[12] Mohammad M. et.al; (2011),[13] Garel C. et.al; (2011),[14] Gao Y. et.al; (2018),[15] Kamal A. et.al; (2019),[16] Ping J. et.al; (2020),[17] Gnawali S. et.al; (2021),[18] Berman S. et.al; (2018),[19] Bayar O. et.al; (2021).[20] Their parameter was significant and population have variation in length of corpus callosum at different age group between both sexes.

4. Conclusion

In summary, this exploration into the role of MRI in the precise measurement of the Corpus Callosum aims to provide a comprehensive overview of the current state of the field. By addressing technological advancements, methodological considerations, and clinical applications, this review contributes to the ongoing dialogue surrounding the pivotal role of MRI in advancing our understanding of the Corpus Callosum and its significance in both health and disease. As we navigate through the subsequent sections, a deeper appreciation of the complexities and potentials of this imaging modality in neuro scientific research and clinical practice will unfold.

5. Source of Funding

None.

6. Conflict of Interest

None.

References

1. Ng WH, Chan YL, Au KSA, Yeung KWD, Kwan TF, To CY, et al. Morphometry of the corpus callosum in Chinese children: relationship with gender and academic performance. *Pediatr Radiol*. 2005;35(6):565–71.
2. Chavarria ME, Sánchez F, Chou YY, Thompson PM, Luders E. Puberty in the corpus callosum. *Neuroscience*. 2014;265:1–8. doi:10.1016/j.neuroscience.2014.01.030.
3. Aboitiz F, Scheibel AB, Fisher RS, Zaidel E. Individual differences in brain asymmetries and fiber composition in the human corpus callosum. *Brain Res*. 1992;598(1-2):154–61.
4. Arda KN, Akay S. The relationship between corpus callosum morphometric measurements and age/gender characteristics: A comprehensive MR imaging study. *J Clin Imaging Sci*. 2019;9:33. doi:10.25259/JCIS-13-2019.
5. Kirthika CP, Siva T, Rajeswaran R, Kalpana R, Francis Y. Morphology and Morphometry of Foetal Corpus Callosum Using MRI - A Retrospective Study. *Biomed Pharmacol J*. 2021;14(2):663–9.
6. Reddy B. Role of Magnetic Resonance Imaging in Morphometric Alterations of Corpus Callosum in Stroke Patients. *Cureus*. 2023;15(2):e35332. doi:10.7759/cureus.35332.
7. Weis S, Kimbacher M, Wenger E, Neuhold A. Morphometric analysis of the corpus callosum using MR: correlation of measurements with aging in healthy individuals. *AJNR Am J Neuroradiol*. 1993;14(3):637–45.
8. Rajapakse J, Giedd JN, Rumsey JM, Vaituzis AC, Hamburger SD, Rapoport JL, et al. Regional MRI measurements of the corpus callosum: a methodological and developmental study. *Brain Dev*. 1996;18(5):379–88.
9. Dorion A, Capron C, Duyme M. Measurement of the corpus callosum using magnetic resonance imaging: Analysis of methods and techniques. *Perceptual Motor Skills*. 2001;92(3, Pt 2):1075–94.
10. Nosarti C, Rushe TM, Woodruff PWR, Stewart AL, Rifkin L, Murray RM, et al. Corpus callosum size and very preterm birth: relationship to neuropsychological outcome. *Brain*. 2004;127(Pt 9):2080–9.
11. Kooij BJM, Handel MV, Uiterwaal C, Groenendaal F, Nievelstein RAJ, Rademaker KJ, et al. Corpus callosum size in relation to motor performance in 9- to 10-year-old children with neonatal encephalopathy. *Pediatr Res*. 2008;63(1):103–8.
12. Rizzo G, Pietrolucci ME, Capponi A, Arduini D. Assessment of corpus callosum biometric measurements at 18 to 32 weeks' gestation by 3-dimensional sonography. *J Ultrasound Med*. 2011;30(1):47–53.
13. Mohammadi M, Zhand P, Moghadam BM, Golalipour MJ. Measurement of the corpus callosum using magnetic resonance imaging in the north of iran. *Iran J Radiol*. 2011;8(4):218–23.
14. Garel C, Cont I, Alberti C, Josserand E, Moutard ML, le Pointe HD. Biometry of the corpus callosum in children: MR imaging reference data. *AJNR Am J Neuroradiol*. 2011;32(8):1436–43.
15. Gao Y. Biometry reference range of the corpus callosum in neonates: An observational study. *Medicine (Baltimore)*. 2018;97(24):e11071. doi:10.1097/MD.0000000000011071.
16. Arda K, Akay S. The Relationship between Corpus Callosum Morphometric Measurements and Age/Gender Characteristics: A Comprehensive MR Imaging Study. *J Clin Imaging Sci*. 2019;9:33.

doi:10.25259/JCIS-13-2019.
17. Ji-Ping Z, Chun-Xiao C, Chong-Feng D, Lei N, Xue-Jun L. The Value of Corpus Callosum Measurement in the Diagnosis of Cerebral Atrophy. *Curr Med Imaging*. 2020;16(6):682–7.
18. Gnawali SE. Measurement of Corpus Callosum Size Using MRI In Nepalese Population. *International Journal of Anatomy and Research*. 2021;9:8079–85.
19. Berman S, West K, Berman S, Does MD, Yeatman JD, Mezer A, et al. Evaluating g-ratio weighted changes in the corpus callosum as a function of age and sex. *NeuroImage*. 2018;182:304–13. doi:10.1016/j.neuroimage.2017.06.076.
20. Bayar O, Baykan A. Evaluation of Corpus Callosum Morphometry in Pediatric Population, is there any Difference Between Genders ? *Int Med J*. 2021;3(2):80–6.

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