

Is your corpus callosum normal?

The left and right sides of your brain are connected via nerve bundles that make up the largest structure within your brain called the corpus callosum. Research highlighted here by Lischke et. al., show that disruptions in this key brain structure may correlate with increased suicidal behaviors in people suffering from borderline personality disorder.

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Background

The corpus callosum is an important structure in the brain made up of white matter that connects both hemispheres. This structure contains four parts, including the genu, rostrum, body, and the splenium.¹ The corpus callosum is known to have an impact on cognition, emotions, and behaviors. Impairment to this structure has shown to cause many diseases like borderline personality disorder, attention deficit hyperactivity disorder, and suicidal behavior.^{2,3} Research into this structure has been studied in-depth on the microscopic level regarding differences in the corpus callosum in patients with borderline personality disorder.⁴ Lischke, Domin, Freyberger along with others, are just some of the people who researched at the University of Greifswald Germany, in the departments of psychiatry, psychology, and psychotherapy.

Diffusion tensor imaging was used to view the microscopic alterations in each of the groups: the healthy control, borderline personality disorder, and the suicidal patients. This imaging allows the movement of water diffusion in the white matter of the corpus callosum. Fractional anisotropy and mean diffusivity was used in characterizing the density and myelination of the fibers inside the structure.⁵ Structures that the corpus callosum connect to that regulate emotions and impulse control in borderline personality disorder suicidal group showed to have decreased thickness than from the healthy control group; this indicated suicidal behavior.⁹

Methods

Two groups were tested, one healthy control group containing 20 women and another meeting the DSM-IV criteria of borderline personality disorder with emotional instability and impulsivity. Strict criteria must've been met, for example, no borderline personality disorder patients on medications of any sort, and schizophrenic personality and attention deficit hyperactivity disorder were to be excluded. The reason for this was shown to have an effect on the integrity of the structure of the corpus. All participants were women in the age range of 18-45 years old, with all right-handed women, being the same sex and age groups.^{6,7,8} A Magnetic Resonance Imaging (MRI) was used in processing each participant in the groups, then used a JavaDTI to calculate the diffusion tensor and determine statistical analyses of the corpus. With this, researchers were able to conduct two sets of analyses, first testing whether the splenium of the corpus had associations in structural alterations in suicidal behavior, and two, seeing if emotional instability and impulsivity were associated in the same regions.¹⁰

Results

Structural alterations were found to be associated with suicidal behavior in borderline personality disorder participants in the corpus callosum. Fractional anisotropy and mean diffusivity were used to determine if specific regions in the corpus correlated negatively or positively with suicidal behavior. In the fractional anisotropy, splenium and genu correlated negatively with suicidal behavior, while in the mean diffusivity, the splenium correlated positively. This shows that regions such as the splenium and genu were associated with regions of the brain that are connected to emotion regulation and impulse control, showing an impact on suicidal thoughts and behavior in those with borderline personality disorder.

Conclusion

Research in the corpus and its structure helps in understanding how patients with disorders are affected and if structural support of the corpus is correlated to such disorders. It's a good start in understanding the neurobiological underpinnings of borderline personality disorder and suicidal behavior in patients with structural alterations. Further studies should be done in seeing how the splenium and genu connect to regions of the brain, such as the prefrontal and tempo-parietal and how both structures play a role in emotions and impulse control.

| Reasons for suicide | Number | Percentage |
|------------------------------|--------|------------|
| Helplessness and desperation | 13 | 100.00 |
| Pain and sorrow | 12 | 92.30 |
| Worthless and guilt | 4 | 30.77 |
| Anger and rage | 4 | 30.77 |
| Loneliness and isolation | 2 | 15.38 |
| Other | 1 | 7.69 |
| Types of self-Injury | | |
| Cutting | 16 | 76.20 |
| Scratching | 16 | 76.20 |
| Biting | 5 | 23.80 |
| Burning | 3 | 14.30 |
| Beating | 8 | 38.10 |
| Bone breaking | 2 | 9.50 |
| Hair pulling | 3 | 14.30 |
| Interfering with wound | 8 | 38.10 |
| healing | | |
| Stabbing | 2 | 9.50 |
| Other | 3 | 14.30 |

Figure 1. Chart for reasons of suicide and types of self-injury from borderline personality disorder.

| | Splenium of CC | Genu of CC | Figure |
|-------------|----------------|------------|-----------------------|
| Fractional | r= -0.45 | r= -0.55 | structure using th |
| Anisotropy | | | doing at |
| Mean | r= 0.45 | r= 0.31 | |
| Diffusivity | | | |

Figure 2. Correlation between structures in the corpus callosum using these methods.

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