

Essay for The Brain, Biology, and Cognition

The highlighted area of the brain that was shown in the image provided which is said to be the damaged area would be the hippocampus, specifically the left hippocampus after much research and consideration. Hence, this essay will explore the cognitive as well as the biological effects to humans when they experience damage or lesions to the left hippocampus. Firstly, the function of the left hippocampus should be stated and defined in order to further understand and delve into the effects of when the left hippocampus is damaged in the human brain. According to Ezzati et al. (2016), the results from their research study confirms the theory that the left hippocampal region of the brain plays a role in episodic and verbal memory, whereas the right hippocampus is used more for spatial memory. Episodic memories are the memories that are attached to an individual's personal experience in life. Episodic memory is a cognitive system that deals with the process of encoding, storing, and retrieving specific previous events (Phillips, 2023). This means that episodic memories are the flashbacks humans get when they reminisce on past experiences. Without the ability for humans to retrieve episodic memories, humans will not be able to remember the experiences they have experienced throughout the course of their lives.

The capacity as well as the ability to create and recall intricate personal memories is primarily linked to the hippocampus and is a defining characteristic of hippocampal amnesia (McCormick et al., 2018). This further highlights accentuates the functions of the left hippocampus which is to store as well as retrieve episodic and verbal memories from the human mind. Therefore, the assumption that was made is that damage to the left hippocampus would

result in degraded or deteriorated episodic and verbal memory. It can be assumed that damage or lesions to the left hippocampus not only prohibits the formation of new episodic and verbal memories, but could also possibly cause damage to already formed memories after receiving damage to the left hippocampus.

An analysis of group differences within the default network areas done by Frings et al. (2009) in their research study showed a significant decrease in connection between the precuneus and the ipsilesional middle temporal gyrus and hippocampus in patients with left hippocampal sclerosis compared to the control group. This shows that damages or lesions to the left hippocampus would cause the inability or the difficulty in being able to retrieve episodic memories as well as the inability to form new episodic memories subsequent to receiving damage to the left hippocampus. This study done by Frings and colleagues also proves that the left hippocampus is in charge of creating and storing episodic and visual memories. Besides that, the study done by Frings et al. (2009) also shows some evidence that when the left hippocampus is damaged or has lesions, humans may have difficulties in forming and retrieving episodic and verbal memories.

Besides that, in the study done by Stepankova et al. (2004), they found that the individuals with left hippocampus lesions and right hippocampus lesions both performed worse on the memory recall test compared to the group of normal individuals. This leads to the confirmation that the left hippocampus is just as important as the right hippocampus when it comes to the formation as well as retention of episodic and verbal memories in humans. Seeing as both the groups of people with left and right hippocampus lesions performed worse in

memory recall tests compared to the normal control group, this shows that the left hippocampus does play a role in maintaining episodic and verbal memory, unlike the results of the study done by Smith and Milner (1989) which was highlighted in their research study. This shows that the latest empirical evidence does suggest issues when it comes to forming or retrieving episodic and verbal memories which is contrary to previous literature that states otherwise.

It is now commonly acknowledged that individuals with injury to both sides of the hippocampus experience difficulties in recalling both distant and recent autobiographical memories, particularly when the task involves the recollection of vivid and detailed information (McCormick et al., 2018). In the study done by McCormick et al. (2018), it is said that damage to the hippocampus, both left and right, would lead to difficulties in recalling episodic and verbal memories, be it short term memories or long term memories. On the other hand, individuals suffering from bilateral hippocampus injury are able to recall personal details like their home address and school name (McCormick et al., 2018). This also shows that damage to the left hippocampus does not affect semantic memory, but only episodic and verbal memory.

The left hippocampal region was highly correlated with the test's learning phase, the MMSE, education, and the multivariate regression model, which explained 68.2% of the variation in memory test performance (Paula França Resende et al., 2017). This journal article which was written by Paula Franca Resende and colleagues provides a significant amount of empirical evidence which highlights that the left hippocampus is strongly linked to episodic as well as verbal memories in humans. This also shows that episodic and verbal memory retrieval is stronger and more effective in humans with an intact left hippocampus with no defects or lesions.

Criticisms

Although there are new empirical evidence as of recent years which suggests and shows that damage to the left hippocampus will cause damage to the episodic and verbal memory storage and retrieval in humans, not all studies have shown empirical evidence which suggests that the left hippocampus does in fact cause deterioration in episodic and verbal memories when the left hippocampus is damaged. One example of research that is against the notion that damage to the left hippocampus would cause difficulties in episodic and verbal memory retrieval would be the research study done by Smith and Milner (1989) which was quoted in the study done by Stepankova et al. (2004). The research done by Stepankova and their colleagues determined that Smith and Milner have not seen or come across any substantial evidence of deteriorated episodic and verbal memories when memory recall tests were done on individuals with lesions or damages to the left hippocampus. Nevertheless, the present findings are inversely proportional to the results of Smith and Milner (1981, 1989), who did not observe any impairment in object and location memory within a group of patients with left hemisphere injury (Smith & Milner, 1989 as quoted in Stepankova et al., 2004). Smith and Milner's study have not yielded results in which damages to the left hippocampus have caused the deterioration of the individual's ability to retrieve their episodic and verbal memories. Therefore, the conclusion that damage to the left hippocampus will cause difficulties and the inability to retrieve episodic and verbal memories cannot be made when using Smith and Milner's data from their research study which proved otherwise.

Besides that, a research study done by Jordan (2019) where episodic and verbal memories of rodents with lesions to the right or left hippocampus were tested, yielded the results that only the right hippocampus had a positive correlation with navigation accuracy. Therefore, the authors proposed the hypothesis that the right hemisphere may possess specialisation for spatial navigation (Jordan, 2019). After taking a look at Jordan's research study, according to Jordan, the conclusion can be made that the left hippocampus does not play that important of a role when it comes to retaining episodic and verbal memories. Patients with right medial temporal lobe lesions exhibited lower accuracy in reaching the goal position compared to patients with left-lesion or control participants, despite being provided with a continuous presentation of the goal location (Jordan, 2019). This further solidifies the conclusion that the left hippocampus is still able to retain a significant amount of episodic and verbal memories after receiving damage to said area of the brain. Seeing as the rodents with lesions to the left hippocampus did better in spatial memory tests compared to the rodents with lesions to the right hippocampus, this shows that the right hippocampus is more predominant when it comes to retaining episodic and verbal memories. This is contrary to the hypothesis that the left hippocampus is the area of the brain that is used in retaining and creating episodic and verbal memories, as damage to the left hippocampus does not result in the significant deterioration of episodic and verbal memories as seen in the research study done by Jordan (2019). Jordan's research further supports the notion that damage or lesions to the left hippocampus in humans will not cause the deterioration of the retrieval of episodic and verbal memories.

According to Fortin et al. (2002), there is no solid proof which is substantial enough to draw the conclusion that the hippocampal region plays a role in sequence memory alone, given

its significance for spatial learning and memory in a number of protocols. This means that although the left hippocampus is in charge of forming and retrieving episodic and verbal memories, there is no empirical evidence that suggests that the hippocampus alone carries out the task to retrieve episodic and verbal memories alone. It is clear that the previous literature of Jordan (2019), Smith and Milner (1989) as well as Fortin and colleagues (2002), the results from their research study have given enough empirical evidence which further solidifies the notion that damage to the left hippocampus does not cause difficulties or the inability to retrieve episodic and verbal memories from the human minds.

Conclusion

In conclusion, the hippocampus is clearly a vital organ of the brain that helps develop as well as retrieve the episodic and verbal memory in humans. Among the literature discussed in this essay, there are researchers that have given sufficient empirical evidence which shows that damages or lesions to the left hippocampus will result in the loss of ability to generate as well as retrieve episodic and verbal memories. Researchers such as McCormick et al. (2018), Frings et al. (2009), as well as Stepankova et al. (2004) have all stated in their researches that the left hippocampus, when damaged, will have difficulties in retrieving episodic and verbal memories as seen the data when the individuals with left hippocampus lesions perform worse than the control groups in memory recall tests. In all of their research studies, individuals with lesions in the left hippocampus performed poorly in memory recall tests, proving a strong correlation to the

hypothesis that damage to the left hippocampus will cause difficulties in humans to store and retrieve episodic and verbal memories.

However, many other researchers have also shown evidence in their studies which suggests otherwise. Researchers such as Smith and Milner (1989) as well as Jordan (2019) along with Fortin et al. (2002) have shown empirical evidence in their literature which shows that damage or lesions to the left hippocampus does not cause difficulties in the retrieval of episodic and verbal memories. Although the left hippocampus is in fact the part of the brain which controls the retrieval of episodic and verbal memories whereas the right hippocampus helps in spatial memory, lesions to the left hippocampus does not cause the lack of ability to retrieve episodic and verbal memories. In some literature, the individuals with lesions to the left hippocampus do not perform much worse than the control groups in memory recall tests which shows that their ability to retrieve episodic and verbal memories are still intact.

It should be noted that both stances on the effects of damage or lesions to the left hippocampus have its merits. Neither stance on whether damage or lesions to the left hippocampus will cause the inability to retrieve episodic and verbal memories should be ignored and considered null and void. Seeing as different research that was done have yielded different results when it comes to testing the episodic and verbal memories of individuals with lesions to the left hippocampus, a more systematic test should be done in order to gather data and results that can be validated easily in order to determine whether damage to the left hippocampus actually does cause difficulties in retrieving episodic and verbal memories.

Nevertheless, researchers should further delve into the function of the left hippocampus after it receives damages or lesions in order to further understand the human mind as well as the human brains. Memory is a difficult thing to measure and hopefully in the future, more research can be done in order to understand memory as well as the hippocampus in order for future researchers and scientists to develop preventive measures to avoid memory loss diseases such as dementia and Alzheimer's disease. More research should be done in order to provide better care to the people of the future that are at risk of developing Alzheimer's disease in order to prevent the development of memory loss diseases.

It is not clear whether lesions to the left hippocampus will in fact cause the inability to retrieve episodic and verbal memories, therefore more research should be done in order to gain a more substantial evidence which can give a specific answer to this question.

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