

Abstract

With the dearth of brain imaging research conducted on anger differences, it is important to strengthen research in this area. This study examined the differences in cerebral blood perfusion in concentration measures of 17 brain areas to low and high levels of self-reported anger. Of the 7,413 participants, 4,207 were male. The overall group had a mean age of 40.94 (SD=16.102). Upon intake to Amen Clinics Inc., participants were administered a SPECT scan, yielding outcome variables comprised of 17 brain regions, and also completed a questionnaire packet assessing psychiatric and brain injury symptomatology. A variable denoting levels of anger was created based on anger-related questions from the questionnaire. Analyses indicated a significant difference in rCBF between the two groups in cortical regions, yielding mostly hypoperfusion in the high anger group. Specifically, hypoperfusion was found in the left frontal, parietal, limbic, basal ganglia of the high anger group. Hyperperfusion was found in bilateral occipital lobes for high self-reported anger. These findings suggest that the presence of high anger may have an impact on both neuropsychological and behavioral functioning.

Introduction

- Brain imaging studies previously focused on the general presence of anger have found both left frontal and amygdala activation during anger provocation (Potegal, 2012; Blumer, 2000).
- Some research has hypothesized a relationship between higher anger and approach motivation. Situations that are changeable may lead to increased motivation and activation of the left hemisphere, particularly the frontal lobes (Harmon-Jones, Siegman, Bohlig, & Harmon-Jones, 2010).
- Activation of emotional cortical regions resulting in anger may lead to both commonly seen behavioral outbursts and less known consequential cognitive deficits that are not as heavily considered (Luria, 1976).
- Due to the lack of severity-related anger studies, the current study sought to assess the differences in rCBF in 17 brain regions at Concentration between high and low levels of self-reported anger.
- This investigative study also focused potential neuropsychological sequelae that result from the presence of high anger.

Methods

- Participants were part of a de-identified database comprised of 19,384 patients from an outpatient psychiatric clinic.
- This study was archival and included a sample size of 7,413 adults, 57% of which were males with a mean age of 40.94 (SD=16.102).
- Upon intake, participants completed a questionnaire packet assessing psychiatric and brain injury symptomatology. Available answers ranged from 0 (never) to 4 (very frequently), and multiple questions were combined to create a specific symptom factor. Thus, the higher the total score is, the more impairment being endorsed.
- For this study, a variable of self-reported anger was created using 13 questions that targeted different areas of each construct. Using frequency statistics, individuals were grouped into a high anger (top 25%) or a low anger group (bottom 25%). Individuals falling within the middle 50% of the distribution were not included in the study.
- Also, all participants were administered a SPECT scan at Amen Clinics, Inc., yielding outcome variables comprised of 17 brain regions.

A SPECT Study of Cerebral Blood Perfusion Differences in High and Low Self-Reported Anger



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Results

- Independent samples t-tests were conducted at the .01 level to assess for differences in rCBF in 17 brain regions between individuals with high levels of anger and low levels of anger.
- Individuals with higher levels of self-reported anger had significantly lower rCBF in several regions of the brain as compared with individuals with low levels of self-reported anger.
- Participants with higher self-reported anger were found to have lower rCBF in the left limbic region, basal ganglia, frontal lobe, and parietal lobe.
- Higher rCBF was observed for within bilateral occipital lobes.
- No other significant relationships existed within the current investigation.

Table 1. Independent T-Test Comparisons: High Anger vs. Low Anger Groups

Brain Region	Mean Difference	SE	t	p
Left Limbic	-0.357	.070	-5.118	<.001*
Right Limbic	-0.079	.076	-1.036	.300
Left Basal Ganglia	-0.262	.081	-3.227	.001*
Right Basal Ganglia	0.012	.076	0.161	.872
Left Cerebellum	0.204	.081	2.522	.012
Right Cerebellum	0.065	.092	0.704	.482
Left Frontal	-0.214	.043	-4.923	<.001*
Right Frontal	-0.043	.048	-0.911	.362
Left Occipital	0.234	.071	3.294	.001*
Right Occipital	0.214	.072	2.981	.003*
Left Parietal	-0.167	.058	-2.882	.004*
Right Parietal	-0.062	.073	-0.842	.400
Left Motor Sensory	0.044	.054	0.818	.413
Right Motor Sensory	0.181	.057	3.174	.022
Left Temporal	-0.056	.043	-1.295	.196
Right Temporal	0.137	.060	2.292	.022
Vermis	0.148	.091	1.618	.106

Discussion

- The purpose of this study was to assess the differences in blood perfusion between high and low levels of self-reported anger.
- Analyses denoted significantly less rCBF overall in individuals with high self-reported anger when compared to a low-anger group. Specifically, the high anger participants had less rCBF in the frontal, parietal, basal ganglia, and limbic regions. Elevated rCBF was observed within the high anger group in bilateral occipital regions.
- These results suggest the presence of notable differences between individuals experiencing high levels of anger as compared with individuals experiencing low levels of anger.
- Hypoperfusion to these particular brain regions may lead to deficits in several cognitive functions.
- Limbic system hypoperfusion may suggest drops in motivation for high-anger individuals. Anger-inducing situations that have the potential for change increases left hemisphere approach motivation (Harmon-Jones, Siegman, Bohlig, & Harmon-Jones, 2010). Unchangeable situations however decrease motivation, potentially leading to reduced left hemispheric activation. The results of the current investigation support the notion behind the emotional motivation theory.
- Hypoperfusion in the parietal region, may lead to difficulty with following rules and with visual-spatial tasks such as driving. These individuals may be more likely to experience road rage and in turn get into road accidents. They may also have difficulty in following rules in school and work settings, leading to poorer performances.
- Other higher order cognitive functions such as the maintenance of attention and impulse control may be negatively affected by anger. Lack of impulse control may lead to the reactively aggressive behavioral outbursts that may sometimes be seen in the presence of high anger.
- Hyperperfusion in bilateral occipital lobes suggests high self-reported anger may lead to more uses of emotional imagery or hypervigilance to visual stimuli related to the anger-inducing situation.
- These results also indicated that SPECT analysis could potentially be useful in the neurological aspect of research on the presence of anger and neuropsychological sequelae that may occur as a resulting consequence.

Information

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