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Lie detection with neuroimaging techniques

Resumen

En esta revisión bibliográfica hemos buscado información acerca de la detección de mentiras mediante técnicas de neuroimagen en la literatura de la última década (2010-2019). Estas novedosas técnicas pueden ser útiles ya que son capaces de explorar el funcionamiento del cerebro mientras lleva a cabo determinadas acciones (en este caso la mentira) y esto puede resultar especialmente útil para el campo forense.
Para ello hemos buscado artículos científicos en dos conocidas bases de datos (PubMed y PsycNet), obteniendo finalmente una selección de 42.
Los resultados apuntan en todos los casos a una importante labor del lóbulo frontal, que es esencial en la acción de mentir, junto a otras áreas como el giro cingulado anterior y la unión temporo-parietal; estos resultados parecen ser los mismos tanto en personas sanas como en pacientes con determinadas patologías, al igual que también comparten áreas hombres y mujeres. Tampoco se han encontrado grandes diferencias en los resultados de las distintas técnicas exploradas en la literatura, ni entre las distintas condiciones experimentales.
Como conclusión, consideramos que las técnicas de neuroimagen pueden ser un gran campo de estudio para la detección de mentiras, pero actualmente todavía no cuentan con suficiente validez como para poder ser aplicadas en situaciones reales o del campo forense.

Abstract

In this review we have searched for information about the detection of lies through neuroimaging techniques in the literature of the last decade (2010-2019). These new techniques can be useful because they are able to explore the functioning of the brain while carrying out certain actions (in this case, lying) and this can be especially useful for the forensic field.
For this reason, we have searched scientific articles in two well-known databases (PubMed and PsycNet), finally obtaining a selection of 42.
The results point in all cases to an important work of the frontal lobe, which is pivotal in the action of lying, together with other areas such as the anterior cingulate gyrus and the temporo-parietal junction. These results seem to be the same both in healthy people and in patients with certain pathologies, as well as in men and women. Neither large differences have been found in the results of the different techniques explored in the literature, nor among the different experimental conditions.
In conclusion, we consider that neuroimaging techniques can be a great field of study for the detection of lies, but at present they still don’t have enough validity to be able to be applied in real-life situations or in the forensic field.

LIE DETECTION WITH NEUROIMAGING TECHNIQUES

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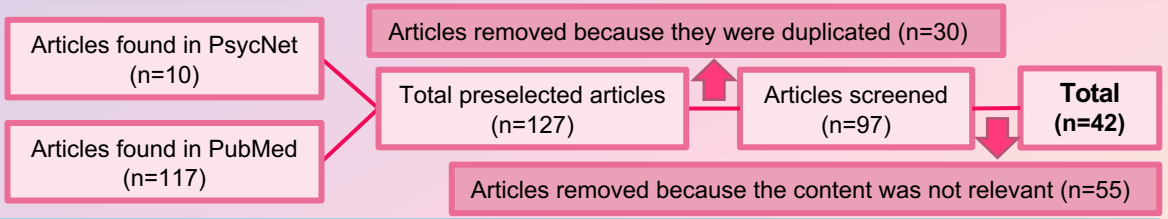
INTRODUCTION

Lying is considered a conscious and intentional way of deceiving. Science has sought methods to detect it, especially for its utility in the forensic field. Attempts of deception detection have been made in multiple ways (verbal and non-verbal language, neurophysiological reactions, etc.), but exploring the brain with neuroimaging techniques may be promising in the future. Therefore, we have reviewed the literature of the last decade (2010-2019) looking for detection of lies using neuroimaging.

METHOD

The articles were searched in two scientific databases (PubMed and PsycNet). The search criteria were "deception" or "lie detection" AND "neuroimaging" in "Title or Abstract" field. The final selection consisted of 42 articles.
*See references in independent annex.



RESULTS AND DISCUSSION

Efficacy of different techniques

- In the comparative study between polygraph and functional magnetic resonance (fMRI) of Langleben et al. (2016), it was concluded that fMRI experts are 24% more likely to detect deception compared to polygraph experts.
- The fMRI and the positron emission tomography (PET) concur in the same results (Kireev, Korotkov, Medvedeva & Medvedev, 2013).
- Functional near infrared spectroscopy (fNIRS) is useful but its detection is limited to less than 3 cm deep (Zhang et al., 2016).

Experimental condition

The articles can be divided into two categories: (1) Executive tasks where the truth or lie is manifested according to instructions given and (2) situations where the subject simulates a deliberate deception. The studies agree on the importance of the fronto-parietal network for any type of lie. There is greater activation of the frontal medial structures in personal information (Mameli et al., 2016), and a possible role of caudate nuclei in deliberate deception (Kireev et al., 2013).

Brain areas

- Dorsolateral prefrontal cortex (DLPFC)
- Ventrolateral prefrontal cortex (VLPFC).
- Anterior cingulate gyrus (ACC)
- Temporo-parietal junction (TPJ)

According to Jiang et al. (2015), we can highlight the role of two networks: the cingulo-opercular network and the fronto-parietal network.

Type of patients

- Only 4 of the 42 articles studied people with certain pathologies (Antisocial Personality Disorder, Schizophrenia and Psycopathic Traits), and their results showed no significant differences compared to healthy participants.
- A single article on gender differences indicates a greater activation of left middle frontal gyrus (MFG) in males during the condition of personal vs. general information. (Marchewka et al., 2012)

CONCLUSIONS

- Neuroimaging techniques: still not have enough validity.
- Frontal lobe: greater activation in lying due to its complexity.

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