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Review

Social cognition in temporal lobe epilepsy: A systematic review and meta-analysis

Emre Bora [a,*], Stefano Meletti [b,c]

[a] The Melbourne Neuropsychiatry Centre, Department of Psychiatry, The University of Melbourne and Melbourne Health, VIC, Australia
[b] Department of Biomedical, Metabolic, and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy
[c] Neurology Unit, NOCSAE Hospital, AUSL Modena, Italy

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ABSTRACT

Objective: There is increasing evidence suggesting that social cognitive abilities are impaired in temporal lobe epilepsy (TLE), the most common form of focal epilepsies.
Methods: In this meta-analysis, 31 studies investigating theory of mind (ToM) and facial emotion recognition performances of 1356 patients with TLE (351 postsurgery) and 859 healthy controls were included.
Results: Patients with TLE had significant deficits in ToM ($d = 0.73–0.89$) and recognition of facial emotions. There were no significant differences in severity of social cognitive deficits between patients with TLE with or without medial temporal lobectomy. Earlier onset of seizures was associated with ToM impairment. Right-sided TLE was associated with more severe deficits in recognition of fear, sadness, and disgust.
Conclusions: Social cognitive information processing is impaired in TLE, and the potential role of these deficits in functional impairment needs to be further investigated.

1. Introduction

Epilepsy is a chronic condition characterized by recurrent seizures. Epilepsy has a significant negative impact on quality of life of patients even if seizures are well-controlled. Individuals with epilepsy have cognitive deficits [1–3] and significant psychosocial difficulties including poor interpersonal relationships, lower level of social relations, and employment [4–6]. Psychosocial difficulties are particularly evident in early-onset epilepsy [6]. Social cognitive impairment, which is an important mediator of psychosocial difficulties in psychiatric disorders [7], is also an important feature of a number of neurological disorders [8–12]. Social cognitive deficits can significantly contribute to psychosocial difficulties in focal epilepsy types characterized by abnormal discharges arising from the temporal and frontal lobes. Temporal lobe epilepsy (TLE), the most common form of focal epilepsy, is characterized by epileptogenic discharges from temporal lobes and is frequently associated with lesions and gliosis/atrophy of the medial temporal lobe. Moreover, resection of the anteromedial lobe is relatively commonly used in treatment-refractory medial TLE.

Over the last decade, there have been an increasing number of studies investigating social cognitive deficits in epilepsy, particularly in TLE [13,14]. Facial emotion recognition is the most commonly studied social cognitive ability in focal epilepsies. The majority of previous studies have found consistent evidence for the impaired performance of facial emotion recognition in TLE [13]. However, there are conflicting findings whether specific emotions are more severely affected (i.e., fear) and whether recognition of happy facial stimuli is preserved. Also, while a number of studies found more severe facial emotion recognition deficits in right-sided TLE, others found no significant difference or more severe deficits in left-sided TLE [13]. It is also not clear whether temporal lobectomy in TLE is associated with different profiles of social cognitive impairment compared with presurgical patients.

More complex aspects of social cognition including theory of mind (ToM) might be potentially more severely affected in TLE. Theory of mind (mentalizing) is the ability to attribute mental states (feelings, beliefs, intentions, and desires) to others and understand and predict others' behavior based on their mental states. The amygdala, temporoparietal junction, and superior temporal sulcus, along with ventromedial prefrontal cortices, are part of the ToM network [15], and pathological changes and functional connectivity abnormalities observed in TLE [16–18] can disrupt the integrity of this network. As they are essential abilities for effective interpersonal functioning, ToM abilities can be particularly relevant for quality of life in TLE. Relatively fewer studies have investigated ToM deficits in epilepsy [14]. Like emotion recognition, most but not all studies have suggested that ToM is impaired in TLE. It remains unclear whether ToM impairment is more sensitive than basic emotion recognition deficits in detecting social cognitive difficulties in TLE.

A meta-analysis of the emotion recognition and ToM findings to date can estimate the severity of these deficits and can help to resolve conflicting findings. The goal of the current meta-analysis was to

* Corresponding author.
E-mail addresses: ibora@unimelb.edu.au, boremre@gmail.com (E. Bora).

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Table 1
Studies included in meta-analysis of social cognition in TLE.

Study	Sample	Characteristics	Social cognition	Neurocognition	Age	Age of onset	Outcome
Ahs et al. [20]	17 TLE-TL+ 19 HC	9 L, 8 R 13 HS	Facial emotion		46.2	13.4	TL is impaired in anger and fear
Amlerova et al. [21]	74 TLE (TL− and TL+) 20 HC	46 TL−, 28 TL+	Faux pas Facial emotion recognition	IQ	35.7	20.3 (TL−) 15.0 (TL+)	Impaired in ToM and emotion recognition no effect of lateralization and surgery
Anderson et al. [22]	23 TLE-TL+ 23 HC	12 right, 11 left TL	Facial emotion	IQ Visuoperceptual tests	35.1	6.4	rTL is impaired
Bonora et al. [23]	41 TLE-TL+ 50 HC	35 HS 20 R, 17 L, 4 bi	Facial emotion	IQ	48.1	20.7	TLE is impaired in recognition of emotions in both channels
Boucher et al. [24]	15 TLE-TL+ 20 HC		Facial emotion RMET	IQ, IRI	38.7		
Brierley et al. [25]	25 TLE-TL+ 32 HC	11 L, 14 R	Facial emotion	IQ, Benton facial Recognition, faces Memory, premorbid IQ (matched)	38.5	12.5	Facial fear, disgust, anger and vocal happiness recognition impaired
Broicher et al. [26]	28 TLE-TL− 29 HC	23 HS	RMET, Faux pas	Premorbid IQ	34.4	20.2	TLE impaired
Carvajal et al. [27]	43 TLE-TL+ 43 HC	20 L, 23 R	Facial emotion	IQ, verbal memory	35.2		No impairment in affect naming. Left TL is impaired in affect discrimination
Cohn et al. [28]	50 TLE-TL− 37 TLE-TL+ HC	42 L, 45 R	TASIT (Sarcasm, deceive)		40.6	16.7	TLE and TL impaired ToM
Fowler et al. [29]	28 TLE (TL+ and TL− mixed) 18 HC	13 TL+ 15 TL−	Facial emotion		38	10.0	No overall impairment Subgroup of patients are impaired
Giovagnoli et al. [30]	109 TLE-TL− 69 HC	62 L, 47 R 43 HS	Faux pas		36.8	21.3	TLE impaired in ToM
Gomez-Ibañez et al. [31]	19 TLE-TL− 23 HC	10 L, 8 R, 1 bi All HS	Facial emotion recognition	TMT, fluency, digit span, verbal memory	41.9	13.0	Both impaired in fear and disgust. No difference
Gosselin et al. [32]	16 TLE-TL+ 16 HC	8 R, 8 L	Facial emotion	IQ	40.7		Recognition of fear impaired. Effect size for anger similar
Hennion et al. [33]	50 TLE-TL− 50 HC		Faux pas Sarcasm Mentalistic action	MoCA	42.4	18.0	ToM impaired Impaired disgust
Hennion et al. [34]	Same	23 R, 27 L 23 HS	Facial emotion	MoCA	42.8		Impaired disgust
Hlobil et al. [35]	36 TLE-TL− 40 TLE-TL+ 28 HC		Facial emotion recognition		30.5	13.2 (TL+) 8.5 (TL−)	
McCagh [36]	27 TLE-TL+ HC		FB stories Hinting		34.7	16.9	TLE impaired
McClelland et al. [37]	12 TLE-TL+ 10 HC		Facial emotion recognition		30.3		Early-onset TLE is impaired
Meletti et al. [38]	63 TLE-TL− 50 HC	33 HS	Facial emotion recognition		36.0	15.0	R TLE impaired, especially in fear
Meletti et al. [39]	176 TLE-TL− 50 HC	68 R, 59 L, 13 bi	Facial emotion recognition		38.6 37.1		Impaired Bilateral most impaired, Right more than left
Meletti et al. [40]	42 TLE-TL+ 39 HC	21 L, 21 R	Facial emotion recognition		45.3	15.3	
Palermo et al. [41]	15 TLE-TL+ 13 HC	7 L, 8 R	Facial emotion recognition	Premorbid IQ	44.9	13.6	
Realmuto et al. [42]	21 TLE-TL− 121 HC		Facial emotion recognition Emotion/intention attribution	Verbal, visual Memory, fluency, WM, visuospatial	37.0	24.3	TLE is impaired in ToM and emotion recognition
Reynders et al. [43]	27 TLE-TL− 12 HC	25 HS	Facial emotion recognition	Visual cognition Face processing	39.4	11.8	Impaired in fear and total (driven by 14 TLE with ictal fear)
Schacher et al. [44]	27 TLE (16 TL−, 11 TL+) 12 HC		Faux pas	IQ		14.3	ToM impaired in TLE Extratemporal normal performance
Sedda et al. [45]	24 R TLE-TL− 32 L TLE-TL− 54 HC	42 HS	Facial emotion recognition	Raven matrices	36.9		
Shaw et al. [46]	19 TLE (TL− and TL+) 19 HC		Facial emotion recognition Happe Faux pas	Benton Hayling	37.2		ToM no difference No difference for recognition of emotions
Tanaka et al. [47]	63 TLE-TL− 32 HC	20 HS 17 R, 26 L, 20 bi	Facial emotion		41.5	30.8	Impaired fear, disgust, total
	25 TLE-TL+	19 HS 11 R, 14 L			43	13.0	Impaired fear, sad, total
Walpole et al. [48]	16 TLE-TL− 14 HC	13 HS	Facial emotion recognition	IQ	45.3	12.8	Impaired

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