

Supplementary Materials

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Table S1. Quality assessment checklist (when criteria were partially met, 0.5 points assigned).

Category 1: Participants
Score (0/0.5/1)
1. Patients were evaluated prospectively, specific diagnostic criteria were applied, and demographic data were reported.
2. Comparison participants were evaluated prospectively psychiatric and medical illnesses were excluded.
3. Important variables (e.g., age, sex, illness duration, onset, medication status, handedness) were checked either by stratification or statistically.
4. Sample size per group > 10.
Category 2: Methods for image acquisition and analysis
5. Whole brain analysis was automated with no <i>a priori</i> regional selection.
6. Coordinates reported in a standard space.
7. The imaging technique used was clearly described so that it could be reproduced.
8. Measurements were clearly described so that they could be reproduced.
Category 3: Results and conclusions
9. Statistical parameters for significant and important non-significant differences were provided.
10. Conclusions were consistent with the results obtained and the limitations were discussed.
TOTAL /10

Table S3. Meta-analysis results of differences in resting state brain activity between ET and HC after excluding Ha et al. 2015.

Brain region	MNI coordinates			SDM Z score	P	No. of voxels	Cluster breakdown (no. of voxels)
	X	Y	Z				
<i>Patients with essential tremor > healthy controls</i>							
R postcentral gyrus	34	-40	56	3.301	~0	2593	R precentral gyrus, BA 6 (575) R postcentral gyrus, BA 3 (395) R precentral gyrus, BA 4 (296) R inferior parietal (excl. supramarginal & angular) gyri, BA 40 (272) R postcentral gyrus, BA 4 (151) R inferior parietal (excl. supramarginal & angular) gyri, BA 2 (101) R postcentral gyrus, BA 2 (91) R superior frontal gyrus, dorsolateral, BA 6 (72) R postcentral gyrus, BA 6 (41) R superior parietal gyrus, BA 2 (36) R superior parietal gyrus, BA 40 (35) R precentral gyrus, BA 3 (24) R postcentral gyrus, BA 40 (19)
L precentral gyrus	-42	0	44	2.405	0.000125408	245	L precentral gyrus, BA 6 (188)
L inferior frontal gyrus	-40	26	-14	2.029	0.000955284	101	L inferior frontal gyrus, orbital part, BA 47 (48) L inferior frontal gyrus, orbital part, BA 38 (27)
<i>Patients with essential tremor < healthy controls</i>							
L insula	-42	-12	16	1.806	0.000464976	451	L rolandic operculum, BA 48 (146) L insula, BA 48 (144) L heschl gyrus, BA 48 (65) L superior temporal gyrus, BA 48 (21)
L cerebellum, hemispheric lobule IV/V	-20	-42	-26	1.740	0.000671923	265	L cerebellum, hemispheric lobule IV/V, BA 37 (92) L cerebellum, hemispheric lobule IV/V, BA 30 (80) Middle cerebellar peduncles (42) L fusiform gyrus, BA 37 (18)
R insula	42	-14	10	1.476	0.002655208	109	R insula, BA 48 (45) R Rolandic operculum, BA 48 (24) R Heschl gyrus, BA 48 (17)

BA, Brodmann area; ET, Essential Tremor; HC, healthy controls; L, left; MNI, Montreal Neurological Institute; R, right; SDM, signed differential mapping; SDM-Z, Seed-based d Mapping Z score. Regions with fewer than 10 voxels are not reported in the cluster breakdown.

Table S4. Subgroup meta-analysis in medication-free ET patients showing hyper- and hypoactivity of brain regions.

Brain region	MNI coordinates			SDM Z score	P	No. of voxels	Cluster breakdown (no. of voxels)
	X	Y	Z				
<i>Patients with essential tremor > healthy controls</i>							
R postcentral gyrus	38	-38	52	2.617	~0	1229	R postcentral gyrus, BA 3 (341) R precentral gyrus, BA 6 (192) R precentral gyrus, BA 4 (168) R postcentral gyrus, BA 4 (145) R inferior parietal (excl. supramarginal & angular) gyri, BA 40 (132) R inferior parietal (excl. supramarginal & angular) gyri, BA 2 (77) R postcentral gyrus, BA 2 (58) R postcentral gyrus, BA 6 (49) R precentral gyrus, BA 3 (28) R postcentral gyrus, BA 40 (25) R superior parietal gyrus, BA 2 (11)
Cerebellum, vermic lobule III	4	-42	-2	1.810	0.001496136	106	Cerebellum, vermic lobule IV / V (50) Cerebellum, vermic lobule IV / V, BA 27 (17) Cerebellum, vermic lobule III (13)
<i>Patients with essential tremor < healthy controls</i>							
R insula	36	-6	8	2.142	0.000132620	653	R insula, BA 48 (290) R lenticular nucleus, putamen, BA 48 (137) R striatum (35) R Rolandic operculum, BA 48 (30) R insula (12)
L insula	-42	-10	18	2.099	0.000162542	634	L insula, BA 48 (229) L Rolandic operculum, BA 48 (179) L superior temporal gyrus, BA 48 (59) L Heschl gyrus (16) L insula (12)

BA, Brodmann area; ET, essential tremor; L, left; MNI, Montreal Neurological Institute; R, right; SDM, signed differential mapping. Regions with fewer than 10 voxels are not reported in the cluster breakdown.

Table S5. Subgroup meta-analysis in ET patients with head tremor showing hyper- and hypoactivity of brain regions.

Brain region	MNI coordinates			SDM Z score	P value	No. of voxels	Cluster breakdown (no. of voxels)
	X	Y	Z				
<i>Patients with essential tremor > healthy controls</i>							
R postcentral gyrus	36	-36	50	2.811	~0	2601	R precentral gyrus, BA 6 (650) R postcentral gyrus, BA 3 (420) R precentral gyrus, BA 4 (321) R postcentral gyrus, BA 4 (189) R postcentral gyrus, BA 2 (181) R inferior parietal (excluding supramarginal and angular) gyri, BA 40 (96) R inferior parietal (excluding supramarginal and angular) gyri, BA 2 (72) R postcentral gyrus, BA 6 (69) R superior frontal gyrus, dorsolateral, BA 6 (31) R precentral gyrus, BA 3 (19) R postcentral gyrus, BA 40 (16) R middle frontal gyrus, BA 6 (13) R postcentral gyrus (13) R precentral gyrus (11)
L inferior frontal gyrus	-46	24	0	2.192	0.000933051	413	L inferior frontal gyrus, orbital part, BA 47 (152) L inferior frontal gyrus, triangular part, BA 47 (69) L inferior frontal gyrus, orbital part, BA 38 (58) L inferior frontal gyrus, triangular part, BA 45 (39) L inferior frontal gyrus (13)
L precentral gyrus	-42	0	42	2.392	0.000345767	195	L precentral gyrus, BA 6 (153) L middle frontal gyrus, BA 6 (28)
<i>Patients with essential tremor < healthy controls</i>							
L cerebellum, hemispheric lobule VI	-22	-72	-24	1.596	0.000769973	1433	L cerebellum, hemispheric lobule VI, BA 37 (435) L cerebellum, hemispheric lobule VI, BA 19 (201) L fusiform gyrus, BA 37 (144) Middle cerebellar peduncles (65) L cerebellum, hemispheric lobule VI (120) L cerebellum, crus I, BA 37 (105) L cerebellum, hemispheric lobule IV/V, BA 37 (94) L cerebellum, crus I (77) L cerebellum, crus I, BA 19 (52) L fusiform gyrus, BA 19 (19) L cerebellum, hemispheric lobule VI, BA 18 (18) L cerebellum, hemispheric lobule IV/V, BA 30 (11)
L insula	-36	-6	16	1.548	0.001107514	331	L insula, BA 48 (163) L rolandic operculum, BA 48 (78) L Heschl gyrus, BA 48 (25) L superior temporal gyrus, BA 48 (17) L Heschl gyrus (11)

BA, Brodmann area; ET, essential tremor; L, left; MNI, Montreal Neurological Institute; R, right; SDM, signed differential mapping. Regions with fewer than 10 voxels are not reported in the cluster breakdown.

Table S6. Subgroup meta-analysis in studies with threshold correction showing hyper- and hypoactivity of brain regions.

Brain region	MNI coordinates			SDM Z score	P	No. of voxels	Cluster breakdown (no. of voxels)
	X	Y	Z				
<i>Patients with essential tremor > healthy controls</i>							
R postcentral gyrus	36	-38	54	2.917	~0	1693	R precentral gyrus, BA 6 (363) R postcentral gyrus, BA 3 (351) R precentral gyrus, BA 4 (277) R postcentral gyrus, BA 4 (192) R inferior parietal (excluding supramarginal and angular) gyri, BA 40 (183) R inferior parietal (excluding supramarginal and angular) gyri, BA 2 (98) R postcentral gyrus, BA 2 (66) R postcentral gyrus, BA 6 (46) R superior frontal gyrus, dorsolateral, BA 6 (31) R precentral gyrus, BA 3 (17) R superior parietal gyrus, BA 2 (11)
<i>Patients with essential tremor < healthy controls</i>							
L insula	-40	-10	18	2.042	0.000149131	634	L insula, BA 48 (229) L rolandic operculum, BA 48 (179) L superior temporal gyrus, BA 48 (59) L Heschl gyrus, BA 48 (58) L inferior frontal gyrus, opercular part, BA 48 (16) L superior temporal gyrus (13) L insula (12)

BA, Brodmann area; L, left; MNI, Montreal Neurological Institute; R, right; SDM, signed differential mapping.
Regions with fewer than 10 voxels are not reported in the cluster breakdown.

Table S7. Subgroup meta-analysis results in studies using fMRI method showing hyper- and hypoactivity of brain regions.

Brain region	MNI coordinates			SDM Z score	P	No. of voxels	Cluster breakdown (no. of voxels)
	X	Y	Z				
<i>Patients with essential tremor > healthy controls</i>							
R postcentral gyrus	36	-40	54	2.723	~0	1736	R precentral gyrus, BA 6 (357) R postcentral gyrus, BA 3 (285) R precentral gyrus, BA 4 (194) R inferior parietal (excl. supramarginal & angular) gyri, BA 40 (191) R postcentral gyrus, BA 4 (172) R inferior parietal (excl. supramarginal & angular) gyri, BA 2 (118) R postcentral gyrus, BA 2 (71) R superior frontal gyrus, dorsolateral, BA 6 (69) R postcentral gyrus, BA 6 (41) R superior parietal gyrus, BA 2 (28) R superior parietal gyrus, BA 40 (19) R precentral gyrus, BA 3 (17) R postcentral gyrus, BA 40 (12)
<i>Patients with essential tremor < healthy controls</i>							
L cerebellum, hemispheric lobule VI	-38	-50	-28	2.005	0.000387549	1855	L cerebellum, hemispheric lobule VI, BA 37 (473) L fusiform gyrus, BA 37 (232) L cerebellum, crus I (202) L cerebellum, hemispheric lobule VI, BA 19 (187) L cerebellum, hemispheric lobule IV / V, BA 37 (184) Middle cerebellar peduncles (157) L cerebellum, hemispheric lobule VI (87) L cerebellum, crus I, BA 37 (79) L cerebellum, hemispheric lobule IV / V, BA 30 (70) L cerebellum, crus I, BA 19 (62)
L insula	-42	-12	16	1.965	0.000487208	448	L insula, BA 48 (171) L rolandic operculum, BA 48 (157) L heschl gyrus, BA 48 (59) L superior temporal gyrus, BA 48 (13) L postcentral gyrus, BA 48 (11)

BA, Brodmann area; ET, essential tremor; HC, healthy controls; L, left; MNI, Montreal Neurological Institute; R, right; SDM, signed differential mapping; SDM-Z, Seed-based d Mapping Z score. Regions with fewer than 10 voxels are not reported in the cluster breakdown.

Table S8. Jackknife sensitivity analysis of subgroup meta-analysis in medication-free ET patients.

Discarded studies	Hyperactivity region		Hypoactivity region	
	R postcentral gyrus	cerebellar Vermis	R insula	L insula
Jenkins et al., 1993	Y	Y	Y	Y
Wills et al., 1994	Y	Y	Y	Y
Fang et al., 2013	Y	Y	Y	N
Fang et al., 2015	Y	Y	Y	Y
Yin et al., 2016	Y	N	Y	Y
L. Wang et al., 2018 ^a	Y	N	Y	Y
	Y	Y	Y	Y
Li et al., 2020	Y	N	Y	N
Total Y	8/8	5/8	8/8	6/8

^a two data sets included.

Y, Yes; N, No; Y, brain regions were significant in jackknife analysis; N, brain regions not significant in jackknife analysis. Abbreviations: ET, essential tremor; L, left; R, right.

Table S9. Jackknife sensitivity analysis of subgroup meta-analysis in ET patients with head tremor.

Discarded studies	Hyperactivity region			Hypoactivity region	
	R postcentral	L inferior	L precentral	L cerebellum	L insula
	gyrus	frontal gyrus	gyrus		
Fang et al., 2013	Y	Y	Y	Y	N
Fang et al. 2015	N	N	Y	N	Y
Yin et al., 2016	Y	Y	Y	Y	Y
L. Wang et al., 2018	Y	Y	Y	Y	Y
P. Wang et al., 2018	Y	Y	Y	Y	Y
Song et al., 2013	Y	Y	Y	Y	Y
Li et al., 2020	Y	Y	Y	Y	Y
Total Y	6/7	6/7	7/7	6/7	6/7

Y, Yes; N, No; Y, brain regions were significant in jackknife analysis; N, brain regions not significant in jackknife analysis.

Abbreviations: ET, essential tremor; L, left; R, right.

Table S10. Jackknife sensitivity analysis of subgroup meta-analysis of studies with correction threshold.

Discarded studies	Hyperactivity region		Hypoactivity region	
	R postcentral gyrus		L insula	
Jenkins et al., 1993	Y		Y	
Wills et al., 1994	Y		Y	
Fang et al., 2013	Y		Y	
Fang et al., 2015	Y		Y	
Yin et al., 2016	Y		Y	
L. Wang et al., 2018 ^a	Y		Y	
	Y		Y	
P. Wang et al., 2018	Y		Y	
Li et al., 2020	Y		Y	
Total Y	9/9		9/9	

^a two data sets included.

Y, Yes; N, No; Y, brain regions were significant in jackknife analysis; N, brain regions not significant in jackknife analysis. Abbreviations: ET, essential tremor; L, left; R, right.

Table S11. Jackknife sensitivity analysis of subgroup meta-analysis in studies using fMRI method.

Discarded studies	Hyperactivity region	Hypoactivity region	
	R postcentral gyrus	L cerebellum	L insula
Fang et al., 2013	Y	Y	N
P. Wang et al., 2015	Y	Y	Y
Benito-león et al., 2015	Y	Y	Y
Fang et al., 2015	Y	Y	Y
Yin et al., 2016	Y	Y	Y
L. Wang et al., 2018 ^a	Y	Y	Y
	Y	Y	Y
P. Wang et al., 2018	Y	Y	Y
Li et al., 2020	Y	Y	N
Total Y	9/9	9/9	7/9

^a two data sets included.

Y, Yes; N, No; Y, brain regions were significant in jackknife analysis; N, brain regions not significant in jackknife analysis. Abbreviations: ET, essential tremor; L, left; R, right.

Table S12. Jackknife sensitivity analysis of meta-analysis results after excluding Ha et al. 2015.

Discarded studies	Hyperactivation regions			Hypoactivation regions		
	R	L	L	L	L	R
	PoCG	PreCG	IFG	INS	Cerebellum	INS
Jenkins et al., 1993	Y	Y	Y	Y	Y	Y
Wills et al., 1994	Y	Y	Y	Y	Y	Y
Czarnecki et al., 2011	Y	Y	Y	Y	Y	Y
Fang et al., 2013	Y	Y	Y	N	N	N
P. Wang et al., 2015	Y	Y	Y	Y	Y	Y
Benito-león et al., 2015	Y	Y	Y	Y	N	N
Fang et al., 2015	Y	Y	N	Y	Y	Y
Yin et al., 2016	Y	Y	Y	Y	Y	Y
L. Wang et al., 2018 ^a	Y	Y	Y	Y	Y	N
	Y	Y	Y	Y	Y	Y
P. Wang et al., 2018	Y	Y	Y	Y	Y	Y
Song et al., 2013	Y	Y	N	Y	Y	Y
Li et al., 2020	Y	Y	Y	N	Y	N
Total Y	13/13	13/13	11/13	11/13	11/13	9/13

^a two data sets included.

Y, Yes; N, NO; “Yes” indicates that the brain regions were significant in the jackknife analysis; “No” indicates that the brain regions were not significant in the jackknife analysis.