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The Prevalence and Influencing Factors of Posttraumatic Stress Disorder in Patients with Myocardial Infarction: A Systematic Review and Meta-analysis

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Abstract: With the accelerated pace of population aging in China, the number of patients suffering from myocardial infarction (MI) is increasing annually. During disease progression, patients are at significantly higher risk of developing severe negative emotions, and emerging evidence suggests that post-traumatic stress disorder (PTSD) is significantly associated with cardiovascular disease, which seriously affects patients' quality of life. *Objective:* The aim of this study was to comprehensively assess the prevalence and influencing factors of PTSD in MI patients through systematic review and Meta-analysis. Methods:A computerized search of PubMed, the Cochrane Library, Embase, Web of Science, PsycINFO, China Knowledge Network (CNKI), WanFang Data, VIP, and China Biomedical Literature Database (CBM) was conducted to collect longitudinal studies, case-control studies, and cross-sectional studies related to PTSD prevalence rates and influencing factors in MI patients published up to August 1,2024.Literature screening, data extraction and quality assessment were done independently by two researchers and Meta-analysis was done using Stata 16.0 software. This study has been registered on the PROSPERO platform, registration number: CRD42024577243. *Results:* A total of 16 papers were included, with a total sample size of 3,768 cases involving 8 influencing factors.The results of the Meta-analysis showed that the prevalence of PTSD in patients with MI was 20.4% (95% *CI* = 15.0–26.5%). Female (*OR* = 3.12, 95% *CI* = 1.97–4.97, $P < 0.001$), high neuroticism score (*OR* = 2.21, 95% *CI* = 1.20–4.07, $P = 0.011$), and high intrusive rumination score (*OR* = 2.95, 95% *CI* = 1.50–5.83, $P = 0.002$) were the risk factors for PTSD in MI patients. While age (*OR* = 1.01, 95% *CI* = 0.98–1.04, $P = 0.440$), education level (*OR* = 0.55, 95% *CI* = 0.07–4.48, $P = 0.574$), social support rating scale (*OR* = 0.81, 95% *CI* = 0.52–1.26, $P = 0.346$), Killip cardiac function classification (*OR* = 2.29, 95% *CI* = 0.91–5.80, $P = 0.080$) and creatine kinase isoenzyme (*OR* = 1.03, 95% *CI* = 0.99–1.05, $P = 0.124$) were not associated with the development of PTSD in MI patients. *Conclusion:* The prevalence of PTSD was higher in patients with MI. The prevalence varied by evaluation tool and study area. Risk factors were multifactorial, including general factors (female) and overall assessment (high neuroticism score, high invasive rumination score). Therefore, early intervention and proper

de-escalation of PTSD symptoms in patients with MI by medical staff are needed in clinical practice to reduce the risk of PTSD.

Keywords: Myocardial infarction; Post-Traumatic Stress Disorder; Prevalence; Influencing factors; Meta-Analysis

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1. Introduction

The Global Burden of Disease (GBD) study indicates that the total number of cases of cardiovascular disease (CVD) increased from 271 million in 1990 to 523 million in 2019, with the number of deaths from CVD increasing from 12.1 million to 18.6 million, posing a serious threat to people's health [1]. Myocardial infarction (MI) is a major cause of death in CVD, with rapid onset, fast progression, and high mortality, which can lead to surviving patients experiencing various forms of physical and psychological stress [2–4]. Post-traumatic stress disorder (PTSD) refers to an individual's experiencing traumatic events, heightened arousal, and persistent avoidance or numbing after experiencing a significant physiological or psychological stimulus, which is a potential traumatic event [5]. Its main harm lies in the patient's psychological disorder and reduced adherence to treatment, which seriously affects the patient's prognosis [6]. There is increasing evidence of a bidirectional relationship between PTSD and CVD [7,8]. Great psychological stimulation usually leads to PTSD in patients, affecting their physical and mental health, increasing the risk of adverse cardiovascular events [9], hospitalization rates, and mortality rates in affected patients, resulting in a significant public health burden [10]. Currently, more cross-sectional studies have been conducted at home and abroad to explore the prevalence and risk factors of PTSD in patients with MI, but the limitations of the sample size, study area and diagnostic criteria have led to large differences between the findings. Jacquet-Smailovic et al. [11] showed that the incidence of PTSD symptoms in patients with MI within 12 months after discharge from the hospital ranged from 3.00 to 19.00%. Cao et al. [12] showed that the prevalence of PTSD symptoms in Chinese MI patients from the acute phase to 3 months after discharge was 20.40–33.10%. A meta-analysis found that the incidence of PTSD symptoms due to heart disease ranged from 0% to 38.00% [13]. Previous studies have shown that PTSD symptoms in patients with MI may be related to patients' age, gender, and personality traits [14]. Related studies have found that hippocampal damage, serum cortisol, and C-reactive protein are predictors of PTSD symptoms [15–17]. However, there is a lack of comprehensive reports on the prevalence and influencing factors of PTSD in MI patients. Based on this, this study investigated the prevalence and risk factors of PTSD in patients with MI by meta-analysis, aiming to provide a reference basis for effective clinical intervention and preventive management.

2. Methods

2.1. Study registration

This study was registered in the International Prospective Register of Systematic Reviews (PROSPERO Registration No.: CRD42024577243) and was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. This article reports the results of a literature search and does not involve any animal, cell, or human experimental research. This study did not require ethics approval in China.

2.2. Search strategy

Computerized searches of PubMed, the Cochrane Library, Embase, Web of Science, PsycINFO, China Knowledge Network (CNKI), WanFang Data, Wipo Chinese Scientific and Technical Journal Database (VIP) and China Biomedical Literature Database (CBM) for MI Literature related to the factors affecting PTSD in patients was searched with the time limit of building the database to August 01, 2024. The search was conducted using a combination of subject terms and free terms, and the Chinese search terms included "myocardial infarction," "post-traumatic stress disorder, post-traumatic stress symptoms, traumatic stress disorder, post-traumatic neurosis, post-traumatic stress reaction," "influencing factors, risk factors, associated factors, predictors, related," etc. English search terms include "Myocardial Infarction*, Infarction*, Myocardial, Heart Attack*, Myocardial Infarct*, Infarct*, Myocardial *OR* Cardiovascular Stroke* *OR* Stroke*, Cardiovascular," "Stress Disorder*, Post-Traumatic, Post-Traumatic Stress Disorder*, Post Traumatic Stress Disorder*, Neuroses, Post Traumatic, PTSD, Stress Disorder*, Post Traumatic, Posttraumatic Stress Disorder* *OR* Stress Disorder*, Posttraumatic," "Risk Factors, Associated Factor, Relevant Factor*, Predicted Factor*, Influencing Factor*, Correlation," etc. In addition, the references of the included literature were traced. Using PubMed as an example, the specific search strategy is shown in **Table 1**.

2.3. Eligibility and exclusion criteria

Inclusion criteria: (1) The subjects were clinically diagnosed as MI patients; (2) Types of studies include observational studies, including cohort studies, case-control studies, and cross-sectional studies; (3) The study focused on the prevalence and influencing factors of PTSD in MI patients; (4) The outcome measure was PTSD in MI patients; (5) The literature is in Chinese and English.

The exclusion criteria were as follows: (1) The subjects had PTSD before they were diagnosed with MI; (2) Unable to extract valid data or incomplete data literature; (3) The literature types were reviews, case reports, conference abstracts or book chapters; (4) Repeated publications and non-availability of full texts.

2.4. Data extraction

Literature screening, extraction of information and cross-checking were carried out independently by 2 researchers. Disagreements, if any, were resolved by mutual agreement or consultation with the third researcher until the results were consistent. Literature screening was performed in strict accordance with the inclusion and exclusion criteria; after eliminating duplicates, irrelevant literature was excluded by reading the title and abstract, and the rest of the literature was read in its entirety to determine inclusion. Relevant information was extracted and literature related to this study was obtained through the literature tracking method. For articles where available data could not be obtained directly, emails were sent to authors requesting relevant data. Data extraction included: first author, year of publication, type of study, study area, total sample size, number of PTSD cases, PTSD assessment tool, time of PTSD assessment, PTSD incidence and influencing factors.

Table 1. Search strategies of PubMed

Number	Search strategy
#1	("Myocardial Infarction" [Mesh]) *OR* (Infarction*, Myocardial [Title/Abstract] *OR* Myocardial Infarction*[Title/Abstract] *OR* Heart Attack*[Title/Abstract] *OR* Myocardial Infarct*[Title/Abstract] *OR* Infarct*, Myocardial [Title/Abstract] *OR* Cardiovascular Stroke*[Title/Abstract] *OR* Stroke*, Cardiovascular [Title/Abstract])
#2	("Stress Disorders, Post-Traumatic"[Mesh]) *OR* (Post-Traumatic Stress Disorder*[Title/Abstract] *OR* Stress Disorder*, Post-Traumatic[Title/Abstract] *OR* Post Traumatic Stress Disorder*[Title/Abstract] *OR* Neuroses, Post-Traumatic[Title/Abstract] *OR* Neuroses, Post Traumatic[Title/Abstract] *OR* Post-Traumatic Neuroses[Title/Abstract] *OR* PTSD[Title/Abstract] *OR* Stress Disorder*, Post Traumatic[Title/Abstract] *OR* Posttraumatic Stress Disorder*[Title/Abstract] *OR* Stress Disorder*, Posttraumatic[Title/Abstract] *OR* Neuroses, Posttraumatic[Title/Abstract] *OR* Posttraumatic Neuroses[Title/Abstract] *OR* Delayed Onset Post-Traumatic Stress Disorder[Title/Abstract] *OR* Delayed Onset Post Traumatic Stress Disorder[Title/Abstract] *OR* Post-Traumatic Stress Symptom*[Title/Abstract] *OR* Posttraumatic Stress Symptom*[Title/Abstract] *OR* PTSS[Title/Abstract])
#3	("Risk Factors" [Mesh]) *OR* (influence factor*[Title/Abstract] *OR* associated factor*[Title/Abstract] *OR* relevant factor*[Title/Abstract] *OR* risk factor*[Title/Abstract] *OR* predicted factor*[Title/Abstract] *OR* Influencing Factor*[Title/Abstract] *OR* Correlation [Title/Abstract])
#4	#1 AND #2 AND #3

2.5. Quality assessment

Literature quality was independently evaluated by 2 researchers and cross-validated, and if there were disagreements between the two parties, a 3rd party intervened to discuss and resolve the issue. The quality of literature included in the cohort and case-control studies was rated using The Newcastle-Ottawa Quality Assessment Scale (NOS), with a score of 9 out of 9, with 1 to 3 being low quality, 4 to 6 being moderate quality, and 7 to 9 being high quality [18]. Cross-sectional studies were scored using the Agency for Health Care Quality and Research (AHRQ), which has a total of 11 entries, with each entry receiving a score of 1 if it was rated as "yes," "no" or "high" [19]. If each entry is rated as "yes," it will be scored as 1 point, and if it is rated as "no" or "unclear," it will be scored as 0 points out of a total of 11 points, with 0–3 points as low quality, 4–7 points as medium quality, and 8–11 points as high quality.

2.6. Statistical analysis

Meta-analysis of the extracted data was performed using Stata 16.0 software. Effect sizes were expressed using the combined rate and its 95% Confidence Interval (*CI*), and influence factors were expressed using Odds Ratio (*OR*) and its 95% *CI* combined effect size. The included literature was tested for heterogeneity, and the size of heterogeneity was quantified using the I^2 test; if there was no statistically significant heterogeneity between the results of the studies ($P > 0.1$, $I^2 < 50\%$), Meta-analysis was performed using the fixed-effects model; if there was statistically significant heterogeneity between the results of the studies ($P < 0.1$, $I^2 \geq 50\%$), Meta-analysis was performed using the random-effects model. Obvious clinical heterogeneity was dealt with by methods such as sensitivity analysis or subgroup analysis; sensitivity analysis was performed using the one-by-one exclusion method and changing the merger model to determine the stability of the study results. Impact factors for inclusion of ≥ 10 papers were used to detect publication bias in the literature. Differences were considered statistically significant at $P < 0.05$.

3. Results

3.1. Overview of included studies for the systematic review

A total of 16 studies were included [12,16,20–33]. Among them, 8 were in Chinese [20,22–26,28,29], and 8 were in

English [12,16,21,27,30–33]. The database search yielded 736 articles; 169 duplicate publications were excluded, 460 articles were excluded after reading the titles and abstracts, 93 articles were excluded after full-text re-screening, 14 articles were finally included, and 2 articles were included in the manual search. The literature screening process and results are shown in **Figure 1**.

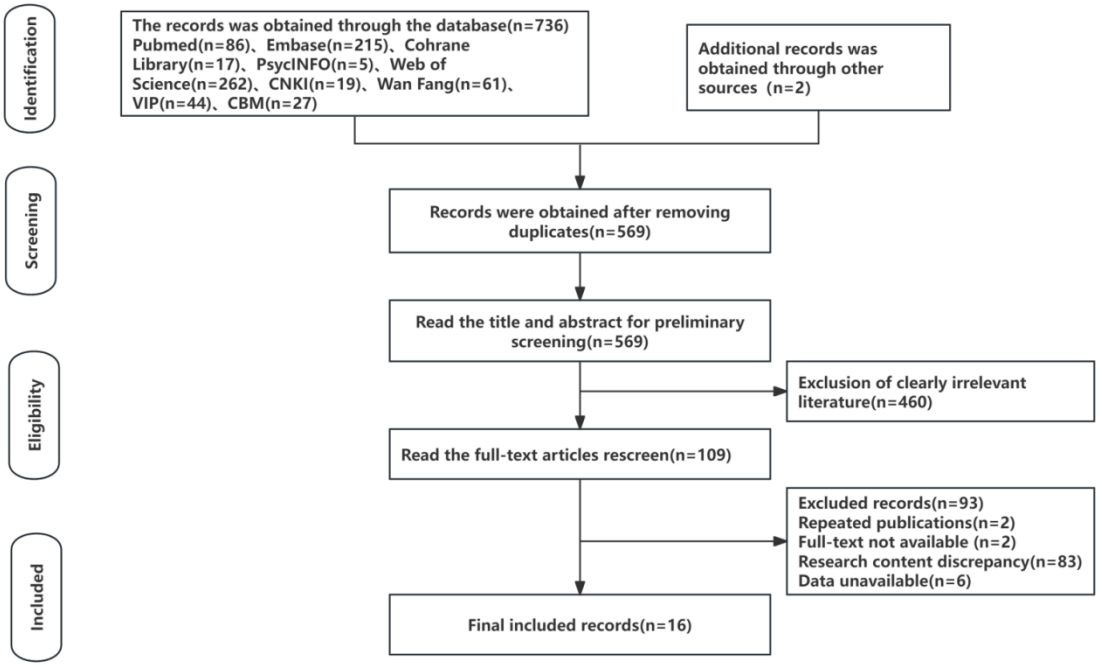

Figure 1. Literature screening flow chart and results.

3.2. Basic characteristics and quality evaluation of the included documents

The basic characteristics of the included studies and the methodological quality evaluation of the literature are shown in **Table 2**, 16 studies were included, with a total sample size of 3768 cases. The 16 articles included 12 cross-sectional studies [12,16,20,21,23–29,31], 3 cohort studies [30,32,33], and 1 case-control study [22]. According to the literature quality evaluation criteria, the quality evaluation of 10 studies was ≥ 6 points, and the quality of the included studies was relatively reliable.

3.3. Meta-analysis of PTSD prevalence in patients with myocardial infarction

3.3.1. Overall prevalence

A meta-analysis was performed on the prevalence of 15 included papers [12,16,20,21,23–33]. There was significant heterogeneity among the studies (I^2 = 94.748%, P < 0.001), so the random-effects model was used for the combination. The results showed that the prevalence of PTSD in MI patients was 20.4% (95% *CI* = 15.0–26.5%), as shown in the forest diagram (**Figure 2**).

Table 2. Basic characteristics of included literature

Author	Year	Country	Study types	Sample sizes	Case	Prevalence	PTSD assessment tools	PTSD assessment time	Influencing factors	quality score
Wang[20]	2024	China	A	200	56	28.00%	PCL-C	60 days after the onset of MI	1、2、3、4	9
Cui[21]	2022	China	A	287	92	32.06%	PCL-C	30 days after discharge	5、6、7、8、9	8
Feng[22]	2022	China	B	72	32	—	PCL-S	—	10、11、12、13	7
Peng[23]	2021	China	A	243	83	34.00%	PCL-C	—	—	9
Cao[12]	2021	China	A	113	23	20.40%	PCL-C	3 months after the onset of MI	14、15	9
Gao[24]	2019	China	A	266	85	32.00%	PCL-C	60 days after the onset of MI	1、3、4	9
Ni[25]	2019	China	A	300	86	28.70%	PCL-C	—	1、7、16、17	8
Li[26]	2018	China	A	193	56	29.02%	PCL-C	2 to 3 months after discharge	—	7
Bielas[16]	2018	Switzerland	A	183	14	7.70%	PDS	3 months after the onset of MI	10、18、19	8
Lima[27]	2018	America	A	271	32	11.80%	PCL-C	—	—	8
Liang[28]	2016	China	A	178	41	23.03%	PCL-C	More than 1 month after the onset of MI	1、4、20、21	7
Xiong[29]	2014	China	A	240	68	28.30%	PCL-C	It has been more than 1 month since the first onset of MI	2、5、13	8
Dinenberg[30]	2014	America	C	579	37	6.40%	CDIS	5 years after the onset of MI	22、23、24	8
Wiedemar[31]	2008	Switzerland	A	190	18	9.50%	PDS	—	—	6
Pedersen(1)[32]	2004	Denmark	C	226	34	—	PDS	4 to 6 weeks after onset of MI	4、25、26	7
Pedersen(2)[33]	2003	Denmark	C	227	33	—	PDS	4 to 6 weeks after onset of MI	4、27、28	7

Abbreviations: A: Cross-sectional study, B: Case-control study, C: Cohort study. PCL-C: Civilian version of post-traumatic stress disorder scale, PCL-S: Post-traumatic Stress Disorder Rating Scale, PDS: 17-item post-traumatic diagnostic scale, CDIS: DSM-IV Computerized Diagnostic Interview Scale. Influencing factors: 1 = age, 2 = social support score, 3 = invasive rumination score, 4 = neuroticism score, 5 = sex, 6 = diabetes, 7 = CK-MB, 8 = Insomnia score, 9 = disease progression fear score, 10 = educational level, 11 = number of interventions, 12 = economic income, 13 = Killip, 14 = smoke, 15 = LVEF, 16 = cTnI, 17 = total cholesterol, 18 = Symptoms of acute stress disorder, 19 = CRP risk, 20 = degree of despair, 21 = fear of death, 22 = ISEL, 23 = ISEL domain score, 24 =ISEL Tangible domain score, 25 = type D personality, 26 = MI, 27 = anxiety, 28 = depression, —: this item does not exist.

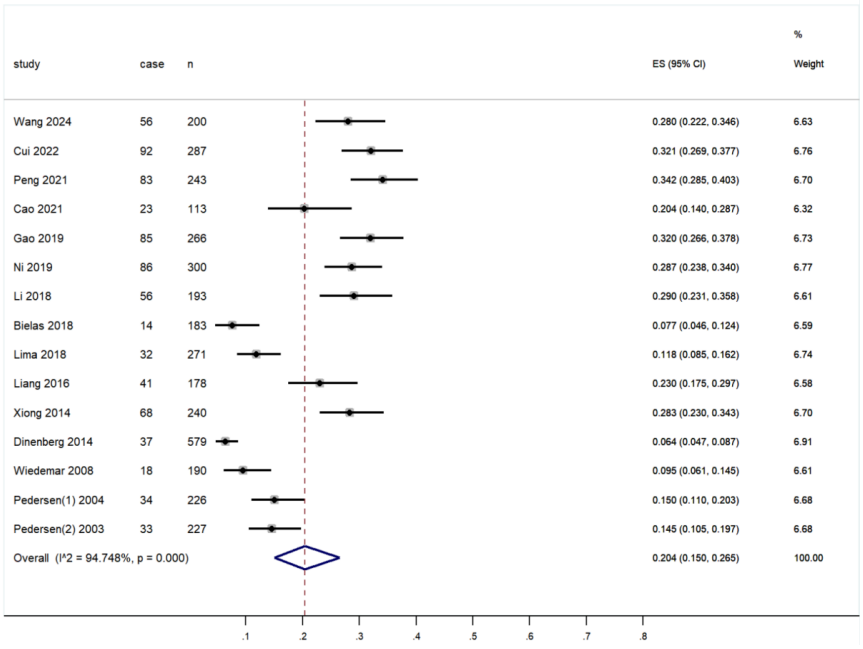

Figure 2. Forest plots for the prevalence of PTSD in myocardial infarction patients.

3.3.2. Subgroup analysis

Subgroup analysis was conducted for the included literatures according to study location and diagnostic criteria, and the results were shown in Table 3. (1) Grouped by study site: Prevalence of MI patients in China and other countries are respectively 28.9% [95% *CI* (26.4%, 31.5%)] and 10.5% [95% *CI* (7.5%, 13.9%)]. (2) According to the evaluation tools used for grouping, the prevalence rates of PTSD among MI patients as assessed by the PTSD Checklist-Civilian Version (PCL-C), the Post-Traumatic Stress Diagnostic Scale (PDS), and the DSM-IV Computerized Diagnostic Interview Schedule (CDIS) are 26.5% [95% *CI* (22.0%, 31.3%)], 11.6% [95% *CI* (8.2%, 15.4%)] and 6.4% [95% *CI* (4.7%, 8.7%)].

Table 3. Results of subgroup analysis of prevalence

Subgroup	Number of articles	Prevalence rate (%)			*P*
		I^2 (%)	Model selection	95%*CI*	
China	9 [12,20,21,23–26,28,29]	38.776	Fix	28.9 (26.4,31.5)	0.110
Other countries	6 [16,27,30–33]	77.324	Random	10.5 (7.5,13.9)	0.001
PCL-C	10 [12,20,21,23–29]	84.666	Random	26.5 (22.0,31.3)	< 0.001
PDS	4 [16,31–33]	62.427	Random	11.6 (8.2,15.4)	0.046
CDIS	1 [30]	—	—	6.4 (4.7,8.7)	—

—: This item does not exist.

3.3.3. Sensitivity analysis

In the study of prevalence, a one-by-one exclusion method was used to eliminate individual studies, followed by a meta-analysis of the remaining literature to obtain a forest plot for sensitivity analysis. The vertical line indicates that the overall combined effect size is 0.21, with all studies evenly distributed on either side of the vertical line, suggesting that the results are relatively stable, as shown in **Figure 3**.

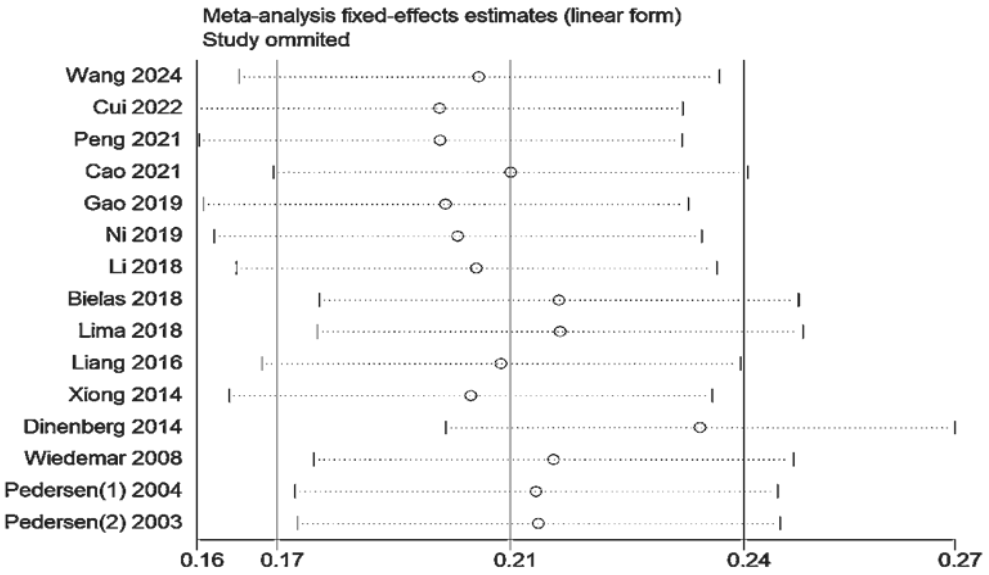

Figure 3. Sensitivity analysis for the prevalence of PTSD in myocardial infarction patients.

3.3.4. Publication bias

Egger's test was used to assess publication bias for studies with a sample size of at least 10.The test results showed $P = 0.267 > 0.05$, indicating that there is no publication bias or that the publication bias is not significant. The funnel plot is shown in **Figure 4**.

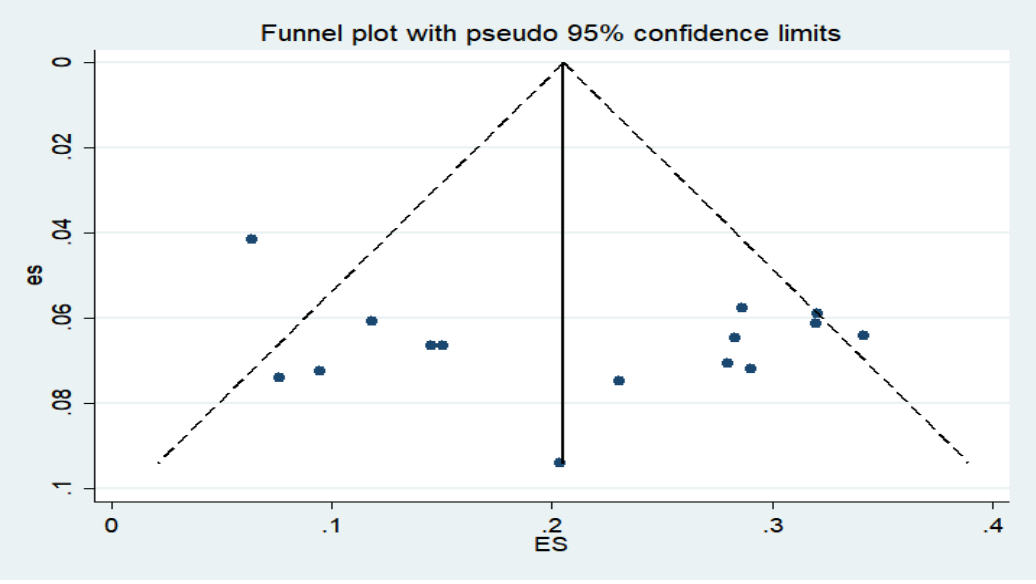

Figure 4. Funnel diagram.

3.4. Results of meta-analysis of influencing factors of PTSD in patients with myocardial infarction

3.4.1. Influencing factors

Influencing factors are shown in **Table 4**.

(1) General Factors

Four studies [20,24,25,28] analyzed the impact of age on the occurrence of PTSD in MI patients, showing heterogeneity between studies ($P < 0.001$, $I^2 = 92.0\%$), the random-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that older age is not a risk factor for PTSD in MI patients (*OR* = 1.01, 95% *CI* = 0.98–1.04, $P = 0.440$). Two studies [21,29] analyzed the impact of gender on the occurrence of PTSD in MI patients, showing no heterogeneity between studies ($P = 0.842$, $I^2 = 0\%$), the fixed-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that being female is a risk factor for PTSD in MI patients (*OR* = 3.12, 95% *CI* = 1.97–4.97, $P < 0.001$). Two studies [16,22] analyzed the impact of education level on the occurrence of PTSD in MI patients, showing heterogeneity between studies ($P = 0.014$, $I^2 = 83.4\%$), the random-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that higher education level is not a risk factor for PTSD in MI patients (*OR* = 0.55, 95% *CI* = 0.07–4.48, $P = 0.574$).

(2) Overall Assessment

Two studies [20,29] analyzed the impact of the Social Support Rating Scale (SSRS) scores on the occurrence of PTSD in MI patients, showing heterogeneity between studies ($P = 0.053$, $I^2 = 73.3\%$), the random-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that low SSRS scores are not a risk factor for PTSD in MI patients (*OR* = 0.81, 95% *CI* = 0.52–1.26, $P = 0.346$). Five studies [20,24,28,32,33] analyzed the impact of neuroticism on the occurrence of PTSD in MI patients, showing significant heterogeneity between studies ($P < 0.001$, $I^2 = 97.6\%$), the random-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that neuroticism is a risk factor for PTSD in MI patient (*OR*=2.21, 95%*CI*=1.20~4.07, *P*=0.011). Two studies [20,24] analyzed the impact of intrusive rumination scores on the occurrence of PTSD in MI patients, showing no heterogeneity between studies ($P = 0.980$, $I^2 = 0\%$), the fixed-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that intrusive rumination scores are a risk factor for PTSD in MI patients (*OR* = 2.95, 95% *CI* = 1.50–5.83, $P = 0.002$). Two studies [22,29] analyzed the impact of Killip classification on the occurrence of PTSD in MI patients, showing heterogeneity between studies ($P = 0.005$, $I^2 = 87.1\%$), the random-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that Killip classification is not a risk factor for PTSD in MI patients (*OR* = 2.29, 95% *CI* = 0.91–5.80, $P = 0.080$).

(3) Laboratory Indicators

Two studies [21,25] analyzed the impact of creatine kinase isoenzyme-MB (CK-MB) on the occurrence of PTSD in MI patients, showing heterogeneity between studies ($P = 0.006$, $I^2 = 86.9\%$), the random-effects model was used to combine effect sizes in a meta-analysis, and the results indicated that CK-MB is not a risk factor for PTSD in MI patients (*OR* = 1.03, 95% *CI* = 0.99–1.05, $P = 0.124$).

3.4.2. Sensitivity analysis

A sensitivity analysis was conducted using a modified combination model to examine the stability of results for four factors: education level, SSRS scores, Killip classification, and CK-MB. The results showed that changing the combination model for the education level factor did not lead to a directional change in the meta-analysis results, indicating stable results. For the SSRS scores, Killip classification, and CK-MB factors, when the fixed-effects model was used to combine effect sizes, the results indicated that SSRS scores (*OR* = 0.96, 95% *CI* = 0.94–0.98,

$P < 0.001$), Killip classification ($OR = 2.60$, 95% $CI = 1.89–3.57$, $P < 0.001$), and CK-MB ($OR = 1.01$, 95% $CI = 1.01–1.02$, $P < 0.001$) are risk factors for PTSD in MI patients, suggesting that these results are unstable.

Another sensitivity analysis was conducted using a leave-one-out method for the factors of age and neuroticism scores to assess result stability. The results indicated that the study by Ni [25] was the main source of heterogeneity for the "age" factor; after removing it, heterogeneity significantly decreased ($P = 0.766$, $I^2 = 0\%$), without affecting result stability. The study by Liang et al. [28] was identified as the main source of heterogeneity for the "neuroticism score" factor; after removing it, heterogeneity noticeably decreased ($P = 0.050$, $I^2 = 61.6\%$), again without affecting result stability.

Table 4. Results of Meta-analysis of influencing factors

Influencing factors	Number of articles	Heterogeneity			Combined effect size		*P*
		I^2 (%)	*P*	Model selection	*OR* value	95%*CI*	
General factors							
Age	4 [20,24,25,28]	92.0	< 0.001	Random	1.01	(0.98,1.04)	0.440
Sex	2 [21,29]	0	0.842	Fix	3.12	(1.97,4.97)	< 0.001
Educational level	2 [16,22]	83.4	0.014	Random	0.55	(0.07,4.48)	0.574
Overall assessment							
SSRS score	2 [20,29]	73.3	0.053	Random	0.81	(0.52,1.26)	0.346
Neuroticism score	5 [20,24,28,32,33]	97.6	< 0.001	Random	2.21	(1.20,4.07)	0.011
Invasive rumination score	2 [20,24]	0	0.980	Fix	2.95	(1.50,5.83)	0.002
Killip grading	2 [22,29]	87.1	0.005	Random	2.29	(0.91,5.80)	0.080
Laboratory indicators							
CK-MB	2 [21,25]	86.9	0.006	Random	1.03	(0.99,1.05)	0.124

3.4.3. Publication bias

Due to the inclusion of fewer than 10 studies for each individual risk factor, the validity of the funnel plot analysis is low; therefore, a funnel plot analysis will not be conducted.

3.4.4. Descriptive analysis

A descriptive analysis was conducted on the results of the studies included in the 16-factor influence analysis for which effect sizes could not be combined. The study by Cui et al. [12] showed that a history of diabetes ($OR = 2.292$, 95% $CI = 1.022–5.138$), insomnia scores ($OR = 2.045$, 95% $CI = 1.483–2.820$), and fear of disease progression score ($OR = 1.126$, 95% $CI = 1.076–1.179$) are risk factors for PTSD in MI patients ($P < 0.05$). The study by Feng et al. [22] indicated that the number of interventions ($OR = 1.381$, 95% $CI = 1.034–3.027$) and economic income ($OR = 1.388$, 95% $CI = 1.067–3.271$) are risk factors for PTSD in MI patients ($P < 0.05$). The research conducted by Cao et al. [12] found that smoking ($OR = 5.12$, 95% $CI = 1.30–20.16$) and left ventricular ejection fraction (LVEF < 50%) ($OR = 0.08$, 95% $CI = 0.02–0.28$) are risk factors for PTSD in MI patients ($P < 0.05$). The study by Ni [25] showed that cardiac troponin I ($OR = 1.068$, 95% $CI = 1.032–1.106$) and total cholesterol ($OR = 11.393$, 95% $CI = 5.355–24.239$) are risk factors for PTSD in MI patients ($P < 0.05$). The research by Bielas et al. [16] indicated that acute stress disorder symptoms ($OR = 1.14$, 95% $CI = 1.04–1.25$) and CRP risk categories (*OR*

= 4.69, 95% *CI* = 1.92–11.45) are risk factors for PTSD in MI patients ($P < 0.05$). The study by Liang et al. [28] found that levels of despair (*OR* = 2.01, 95% *CI* = 1.35–2.67) and fear of death (*OR* = 2.94, 95% *CI* = 2.35–3.26) are risk factors for PTSD in MI patients ($P < 0.05$). Dinenberg et al. [30] reported that scores on the Interpersonal Support Evaluation List (ISEL) (*OR* = 0.69, 95% *CI* = 0.49–0.99), domain scores from ISEL (*OR* = 0.69, 95% *CI* = 0.49–0.98), and tangible support domain scores from ISEL (*OR* = 0.67, 95% *CI* = 0.47–0.96) are risk factors for PTSD in MI patients ($P < 0.05$). Pedersen et al. [32] found that type D personality (*OR* = 4.46, 95% *CI* = 1.36–14.64) and myocardial infarction (*OR* = 4.03, 95% *CI* = 1.43–11.35) are risk factors for PTSD in MI patients ($P < 0.05$). Lastly, Pedersen et al. [33] indicated that anxiety (*OR* = 1.75, 95% *CI* = 1.31–2.33) and depression (*OR* = 1.39, 95% *CI* = 1.18–1.64) are risk factors for PTSD in MI patients ($P < 0.05$).

4. Discussion

4.1. Prevalence rate

The results of this study indicate that the combined prevalence of PTSD in MI patients is 20.4% (95% *CI* = 15.0–26.5%), which is similar to previously reported rates of PTSD incidence in MI patients (21.2%) [34]. There are differences in results among different studies, potentially due to confounding factors such as varying study locations, different hospitals, and different PTSD assessment tools impacting the study outcomes. The subgroup analysis of this study found:

(1) Study Location: The prevalence of PTSD among MI patients in China (28.9%) is higher than that in other countries (10.5%). This may be related to differences in socioeconomic development levels, lifestyle habits, and the population's access to health information among different countries.

(2) Assessment Tools: The prevalence of PTSD in MI patients using the PCL-C scale (26.5%) is higher than that using the PDS scale (11.6%) and the CDIS scale (6.4%), with significant differences among the three. The reason for this discrepancy may be due to the lack of a unified standard for the diagnostic threshold for PTSD in MI patients, both domestically and internationally. Although some studies originated from the same research area and used the same assessment tool, they employed different diagnostic criteria. For example, the study by Cao et al. [12] defined a positive PTSD symptom as a PCL-L score ≥ 44, while the study by Cui et al. [21] defined a positive PTSD symptom as a PCL-L score ≥ 38.

4.2. Influencing factors

This study found that femininity, neuroticism, and invasive rumination scores were risk factors for PTSD in MI patients.

(1) There are gender-based differences in PTSD and cardiovascular diseases. Studies have shown that the lifetime prevalence of PTSD in women is twice that of men [35,36]. Female patients are more likely than male patients to exhibit PTSD symptoms in the face of disease stress, which is consistent with the findings of scholars such as Fonkoue and Kobayashi et al. [37,38]. This may be because there is a significant correlation between the size of the amygdala and PTSD symptoms when individuals are under stress [39]. The amygdala in women tends to respond more persistently and sensitively to ongoing negative stimuli, leading to the emergence of intense emotions such as fear [40]. Additionally, due to the interaction between sex hormones and stress peptides [41], women are more sensitive to painful stimuli and more readily perceive the physical and psychological harm caused by illness. Therefore, it is recommended that clinical

healthcare providers pay special attention to the psychological issues of female MI patients, actively communicate with them to reduce negative emotions, and thus lower the risk of PTSD symptoms.

(2) Neuroticism is positively correlated with PTSD symptoms, indicating that individuals with neurotic personality traits are more likely to develop stress disorders, which is similar to findings from domestic and international studies [28,42,43]. Anxiety and tension are significant manifestations of neurotic personality traits [44]. When faced with severe physical illnesses, these individuals often experience intense unease and anxiety and may misinterpret their condition as a "terminal illness" or something difficult to cure. They often misconstrue common post-treatment discomforts and physical changes as pathological or abnormal and attempt to eliminate them. However, the more they focus on these physical and psychological changes and strive to get rid of them, the worse their symptoms may become, creating a vicious cycle that could ultimately lead to PTSD. Thus, it is recommended that clinical medical staff screen the personality traits of patients exhibiting significant anxiety and tension, if conditions allow, and provide timely targeted psychological counseling and humanistic care to reduce the risk of PTSD.

(3) Intrusive rumination refers to negative and passive thinking following traumatic events [45], and is associated with the occurrence of PTSD. In this study, the scores for intrusive rumination were positively correlated with PTSD symptoms, with higher scores indicating an increased risk of PTSD. This may be because patients with predominant intrusive thoughts tend to focus on the negative aspects of the acute myocardial infarction stress event, making it difficult for them to shift their focus to positive aspects, which can easily trigger depressive emotions. Therefore, it is recommended that clinical healthcare providers pay attention to patients' attitudes towards recovery from illness, guiding them to view their illness and treatment process correctly. By re-evaluating and contemplating the occurrence of their illness, patients can be encouraged to actively face future challenges.

4.3. Limitations

This study has certain limitations: (1) The included literature primarily focuses on populations in China, which may introduce selection bias; (2) The insufficient number of included studies prevents bias assessment, and there may be publication bias; (3) For certain influencing factors, such as a history of diabetes, smoking, and type D personality, fewer than two studies were included, making it impossible to conduct a meta-analysis; (4) Most of the included studies are cross-sectional, lacking prospective research. Therefore, future efforts should involve large sample sizes, multi-center, high-quality prospective studies to discuss and validate the prevalence and influencing factors of PTSD in MI patients.

5. Conclusion

In summary, this study reveals that the prevalence of PTSD among MI patients is 20.4%. Gender, neuroticism, and intrusive rumination scores are identified as risk factors for the occurrence of PTSD in MI patients. Healthcare professionals should pay attention to humanistic care in clinical practice, provide appropriate guidance to alleviate patients' negative emotions, and enhance communication with patients. This is of great significance for reducing and improving the occurrence of PTSD symptoms in MI patients.

Disclosure statement

The authors declare no conflict of interest.

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