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A study into the present situation and factors influencing post-traumatic stress disorder in patients affected by venomous snake bites in Guizhou, China

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Abstract

Objective: To examine the occurrence of post-traumatic stress disorder among patients who have experienced venomous snakebites and investigate the factors contributing to it. The results provided insights for devising suitable nursing interventions. *Methods:* Between June 2022 and October 2023, a total of 128 snakebite patients from the Advanced Snakebite Rescue Center at a tertiary hospital in Guizhou Province were chosen as participants using convenience sampling. General Information Questionnaire, the 10-item Connor-Davidson Resilience Scale (CD-RISC-10), the Social Support Rating Scale (SSRS), the Visual Analog Scale (VAS), the Simple Clinical Severity Assessment Scale, and the Swelling Severity Rating Scale (SSRS) were assessed at the time of admission, and Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C) at 1 month after. *Results:* The prevalence of post-traumatic stress disorder (PTSD) among patients bitten by venomous snakes was found to be 67.97%, with an average PTSD score of 44.26±13.53. Various factors including cultural background, psychological resilience, social support, pain intensity, severity of snakebite, and degree of swelling were identified as influencing PTSD in these patients (all $P < 0.05$).
Conclusion: The incidence of PTSD was increased in individuals with venomous snakebites, particularly among those with lower literacy levels, reduced psychological resilience, limited access to social support, increased pain levels, severe snakebites, and significant swelling. Healthcare professionals should address PTSD in patients with snakebites and implement preventive interventions targeting these high-risk factors to mitigate the occurrence of PTSD in this patient population.

Keywords: Post-traumatic stress disorder, venomous snake bite, nursing, intervention, social support

INTRODUCTION

Venomous snakebite constitutes a distinctive form of surgical emergency, wherein snake venom permeates the bloodstream and lymphatic system, instigating a cascade of complications across multiple bodily systems, including the nervous, cardiovascular, hematologic, and respiratory systems. Marked by swift onset, considerable morbidity, and mortality, this condition poses a grave threat to the affected individual's life if not promptly and effectively managed. Consequently, venomous snakebites have evolved into a pressing global public health issue that cannot be overlooked.[1]

Annually, approximately 5.4 million individuals fall victim to snakebites worldwide, resulting in 1.8 million to 2.7 million instances of poisoning. These incidents contribute to an estimated 81,000 to 138,000 fatalities each year, with an additional 400,000 individuals enduring lasting physical or psychological impairments, such as vision or limb loss, disability, extensive scarring, and mental distress. In China, as per data from 1998, there were 100,000 documented cases of venomous snakebites annually. Alarmingly, 73% of these cases were young and middle-aged , with 25%-30% disabilities and 5%-10% mortalities.[2,3]

Following a venomous snakebite, venom

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infiltrates the body, initiating numerous symptoms including numbness, pain, tissue necrosis, neurotoxicity, inflammatory reactions, subcutaneous petechiae, hemorrhaging, and systemic dysfunction. In certain instances, the toxin can induce symptoms resembling those of myasthenia gravis during the initial phases. Subsequently, advanced stages may precipitate muscle flaccid paralysis, frequently culminating in respiratory obstruction or failure, which can result in death.[4,5]

According to previous investigations, individuals who survive venomous snakebites often endure lasting physical and psychological ramifications, including myotoxicity, renal injury, neurotoxicity, coagulation disorders, and psychiatric symptoms. Nevertheless, clinical management typically prioritizes addressing the acute effects of such bites, with limited exploration of psychological and psychiatric disorders. According to a previous study, there was a 43% likelihood of post-traumatic stress disorder (PTSD) among snakebite survivors, significantly affecting their psychological and social well-being and imposing a substantial burden on both community and families.[6] Given the prevailing focus on clinical treatment and epidemiological analysis of venomous snakebites globally, there is a notable dearth of research addressing psychological issues. Recognizing that health encompasses both psychological and physiological dimensions, it becomes imperative to address the comprehensive needs of affected patients.

Thus, in this study, we aimed to investigate the prevalence and determinants of PTSD among snakebite patients treated at the emergency department of a tertiary hospital in Guizhou Province. The study endeavors to facilitate the development of preventive interventions to PTSD patients with venomous snakebites, thereby contributing to better care and outcomes for these patients.

METHODS

Patients

In this study, we utilized the convenience sampling technique to recruit patients diagnosed with venomous snakebites at the emergency department of a tertiary general hospital in Guizhou Province from June 2021 to October 2022. Inclusion criteria were: ① Meeting the diagnostic standards for venomous snakebites[7]; ② Aged 18 years or older; ③ Voluntary participation; 4 Patients wasconscious and was capable of daily verbal communication. Exclusion criteria were: ① Patients who had encountered other significant stressful events within the past three months; ② Individuals with a history of mental illness. Prior to the study, all participants were provided with detailed information about the study objectives and procedures, and data collection commenced only after obtaining their informed consent. This study was approved by the Ethics Committee of Zunyi Medical University Hospital.

Survey instrument

General information questionnaire: A comprehensive questionnaire was developed by reviewing existing literature and seeking advice from experts. The demographic characteristics, including age, sex, and education level, as well as snakebite severity typing, from all participants were collected. It covers demographic details, disease-related factors, and individual attributes.

CD-RISC-10: The Connor-Davidson Resilience Scale (CD-RISC-10), consisting of 10 items, was employed to evaluate the psychological resilience of the patients. Translated and adapted by Campbell-Sills *et al*., this scale features a unidimensional structure, with each item scored on a 5-point Likert scale ranging from "never = 0" to "always = 4".[8] The total score ranges from 0 to 40 points, with higher scores indicating greater psychological resilience. The CD-RISC-10 demonstrated a total Cronbach's α of 0.877.[9]

Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C): The PTSD Checklist-Civilian Version (PCL-C), also known as the PTSD Symptom Screening Scale, was developed by the PTSD Symptom Research Center in the United States. It is tailored to assess the experience of an individual following trauma encountered in daily life, rather than specifically during wartime scenarios. The scale, introduced and translated by Yang *et al*., comprises three primary syndromes: re-experiencing (5 items), avoidance (7 items), and hypervigilance (5 items).[10] Each item is rated on a scale from 1 to 5, yielding a total score ranging from 17 to 85. A score of 38 or above generally indicates the presence of PTSD symptoms. Internal consistency, as measured by Cronbach's α coefficients, ranged from 0.88 to 0.94 for the scales.[11]

Social Support Rating Scale (SSRS): The scale, developed by Liu *et al*., combines foreign scales with China's specific circumstances.[12] It comprises three dimensions: subjective support, objective support, and utilization of social support, with scores ranging from 12 to 66. The scale evaluates individual social relationships across ten items within these dimensions, with the total score derived from the sum of these entries. Higher scores indicate greater social support, with scores of 22 or lower indicating low support, 23 to 44 indicating moderate support, and 45 to 66 indicating high support. Widely utilized, the scale demonstrates good reliability and validity[13], with a retest reliability of 0.92 and item consistency ranging from 0.89 to 0.94.

Visual Analogue Scale: The Visual Analogue Scale (VAS)[14] is an objective method to evaluate the subjective intensity of a patient's pain and is widely utilized for this purpose. It involves employing a 10 cm long vernier caliper featuring a scale ranging from 0 to 10 on the back. Each number on the scale corresponds to the severity of pain, with higher values indicating more intense pain and lower values indicating less intense pain. A score of 0 signifies the absence of pain, while 10 denotes excruciating pain. Patients indicate their perceived pain level by marking a cross on the front of the scale, with the corresponding score read from the scale on the reverse side. The VAS offers a more intuitive, convenient, and precise method for documenting pain intensity.

Simple Clinical Severity Assessment Scale: The scale is straightforward to remember and is applicable in clinical settings.[15] Snakebite severity can be classified into four categories using this scale. A bite with only tooth marks (dry "bite") signifies no signs of intoxication. Mild cases involve localized manifestations such as pain, ecchymosis, or nonprogressive swelling. Moderate cases exhibit progressing swelling, systemic signs or symptoms, and/or abnormal laboratory findings. Severe cases present with neurological manifestations, respiratory distress, and/or hemodynamic instability or shock.

Degree of local trauma swelling: In this study, we utilized Liu's criteria to categorize the extent of local trauma swelling in snakebites.[16] The circumference of the swelling was assessed, and points were assigned accordingly. No swelling received a score of 0 points; swelling less than 5-7.5 cm was assigned 1 point; swelling between 7.5-50 cm was given 2 points; and swelling ranging from 50-100 cm was allocated 3 points.

Data collection methods

At the time of admission, the patients were provided with individual instructions by a trained research team to complete a series of assessments, including the General Information Questionnaire, the CD-RISC-10, the SSRS, the VAS, the Simple Clinical Severity Assessment Scale, and the Swelling Severity Rating Scale. The research team diligently reviewed each scale to ensure no items were missed and confirmed completion during the session. The questionnaire survey during the recovery process took approximately 15 minutes. Additionally, medical records from hospitalization were examined to collect information on the disease's basic conditions and individual characteristics. Following the patients' specific conditions, the PCL-C scores were assessed via telephone at one month after discharge, resulting in the collection of 128 valid questionnaires.

Statistical methods

The data were collected and analyzed using SPSS version 29.0 statistical software. Descriptive analyses were conducted, presenting frequencies and means with standard deviations. Univariate analysis was performed using independent samples t-test and F-test. Pearson's correlation was used to explore the relationships between pain scores, psychological resilience scores, social support scores, and PTSD scores. Multivariate linear regression was employed to identify the risk factors for PTSD among post-snakebite patients. All tests were two-sided with a significance level set at $\alpha = 0.05$.

RESULTS

General data

Of the total 138 questionnaires distributed, there were 128 valid responses, which resulted in an effective recovery rate of 92.75%. Among the respondents, 40 cases (31.25%) were female, while 80 (68.75%) were male. Additionally, 17 patients (13.28%) were aged 40 years or below. Furthermore, 86 cases (67.19%) had less than elementary school education. It was observed that 83.59% of the patients resided in rural areas, with 72.66% being farmers, and 78.91% having rural health insurance. The severity of snakebite

was reported to be mild in 37.50% of the cases. Notably, the majority of cases (about 44.53%) were categorized as "grade 1" in terms of swelling degree, while 37.50% were classified as grade 2. Further details are presented in Table 1.

Analysis of post-traumatic stress disorder in patients bitten by venomous snakes

The findings of this study revealed that patients bitten by venomous snakes had a mean PTSD score of 44.26±13.53, with a standard deviation of (2.60±0.80) and an incidence rate of 67.97%. Among the three dimensions, the scores ranked highest for re-experiencing (2.81±1.14), followed by hypervigilance (2.75±1.05), and avoidance and numbness (2.35±1.28). Detailed outcomes are provided in Table 2.

Univariate analysis of post-traumatic stress disorder in patients bitten by venomous snakes

Table 1: General data of patients (n = 128)

Variables		Frequency	Percent (%)	Cumulative percent (%)
Gender	Male	88	68.75	68.75
	Female	40	31.25	100.00
Age classification	40 years old and below	17	13.28	13.28
	41-50 years old	111	86.72	100.00
Educational level	Elementary school and below	86	67.19	67.19
	Junior high school	30	23.44	90.625
	High school/college	2	1.56	92.19
	Undergraduate and above	10	7.81	100.00
Type of medical insurance	Rural medical insurance	101	78.91	78.91
	Employee medical insurance	23	17.97	96.88
	Commercial Insurance	4	3.13	100.00
Injury time	≤ 12h	83	64.84	64.84
	> 12h	45	35.16	100.00
Residence	Urban	21	16.41	16.41
	Rural	107	83.59	100.00
Occupation	Laborer	11	8.59	8.59
	Farmer	93	72.66	81.25
	Civil servant	7	5.47	86.72
	Businessman	4	3.13	89.84
	Retired	6	4.69	94.53
	Other	7	5.47	100.00
Severity of snakebite	Not poisoned	36	28.13	28.13
	Mild	48	37.50	65.63
	Moderate	35	27.34	92.97
	Severe	9	7.03	100.00
Swelling degree grading	0 point	12	9.38	9.38
	1 point	57	44.53	53.91
	2 points	48	37.50	91.41
	3 points	11	8.59	100.00
Total		128	100.0	100.0

Table 2: PTSD and scores of each dimension among patients bitten by venomous snakes (n = 128)

Dimension	Number of entries	Score ($\overline{X}\pm S$)	Mean score of entries ($\overline{X}\pm S$)
Re-experiencing	5	14.05±5.69	2.81±1.14
Avoidance and numbness	7	16.46±6.38	2.35±1.28
Increased vigilance	5	13.74±5.25	2.75±1.05
Total PTSD score	17	44.26±13.53	2.60±0.80

The impact of various personality traits on PTSD in patients was analyzed using t-tests and ANOVA. The findings revealed that literacy level, severity of venomous snakebite, and degree of swelling significantly influenced patients with post-snakebite injuries (see Table 3).

Correlation analysis of post-traumatic stress disorder in patients bitten by venomous snakes

Pearson's correlation analysis was conducted to examine the relationship between patients' PTSD scores and various factors. The results revealed that pain scores were positively correlated with PTSD ($r = 0.484$, $P < 0.001$). Conversely, psychological resilience ($r = -0.552$, $P < 0.001$), objective support ($r = -0.350$, $P < 0.001$), subjective support ($r = -0.371$, $P < 0.001$), utilization of support ($r = -0.389$, $P < 0.001$), and total social support score ($r = -0.525$, $P < 0.001$) exhibited negative correlations with patients' PTSD, as presented in Table 4.

Multivariate linear regression analysis of factors affecting PTSD in patients bitten by venomous snakes

A multivariate linear regression analysis was performed, with literacy, pain score, psychological resilience scale, and total social support score as independent variables, and post-traumatic stress disorder as the dependent variable (see Table 5).

DISCUSSION

Analysis of the current status of PTSD in patients bitten by venomous snakes

From the findings of this study, we ascertained that the mean PTSD score among patients bitten by venomous snakes was 44.26±13.53, with a PTSD incidence of 67.97%. The incidence we observed was higher than that reported by Habib *et al*.[6] and Rahman *et al*.[17] The discrepancies in diagnostic criteria and cultural difference may account for these variations. Habib *et al*.[6] conducted a retrospective investigation and found that 42.9% of snakebite patients had PTSD, although they did not specify when the disorder first manifested. According to Rahman *et al*.[17], 27.3% of snakebite victims had PTSD one month after the bite. Similarly, our study found that there was a higher incidence of PTSD in snakebite patients one-month post-bite. However, the previous research did not address whether PTSD manifests in patients prior to one month or at what precise point. Therefore, a large-scale longitudinal study need be carried out in the future to address these questions.

Within the dimensions of PTSD, re-experiencing scored the highest (2.81±1.14), followed by hypervigilance (2.75±1.05), and avoidance and numbing (2.35±1.28). The prominence of the fear of re-experiencing a snake bite suggests that patients often relive the traumatic event, potentially leading to lasting psychological distress. Similarly, heightened hypervigilance reflects a persistent state of alertness likely stemming from the snakebite experience wherein individuals are afraid of even snake-like shapes. Such heightened responses can even cause some disruptions in bodily functions.

However, the lower scores in avoidance and numbing may indicate a relatively favorable prognosis among the surveyed patients, with fewer long-term negative effects. Nevertheless, routine assessment for PTSD among patients with snakebite is crucial for early detection and timely intervention. Tailored treatments, including medication and psychotherapy such as cognitive-behavioral therapy, should be employed to alleviate psychological distress in patients diagnosed with PTSD.[18]

The more severe the swelling and venomous snake bite, the more intense the pain, and the greater the likelihood of PTSD in patients bitten by venomous snakes

The study findings indicated that patients bitten by venomous snakes reported an average pain score of 5.17±2.22 points. The severity of swelling and the grading of the snake bite were

Table 3: Univariate analysis of PTSD among patients bitten by venomous snakes (n = 128)

Variables	Number of cases (n)	PTSD score ($\overline{X}\pm S$)	t/F	*P* value
Gender				
Male	88	43.65±13.64	-0.608*	0.544
Female	40	45.25±14.19		
Age				
40 years old and below	17	47.24±14.11		
41-50 years old	82	46.86±14.41	1.555※	0.215
50 and above.	29	42.55±13.39		
Residence				
Urban	21	43.05±13.71	-0.399*	0.690
Rural	107	44.36±13.84		
Educational level				
Elementary school and below	86	46.47±13.72		
Junior high school	30	39.87±12.72	2.817※	0.042
High school/college	2	45.00±9.90		
Undergraduate and above	10	36.90±14.08		
Type of medical insurance				
Rural medical insurance	101	43.84±13.75		
Employee medical insurance	23	46.13±14.61	0.399※	0.672
Commercial Insurance	4	40.50±10.66		
Injury time				
≤ 12h	83	44.31±12.50	0.170*	0.865
> 12h	45	43.84±16.02		
Occupation				
Laborer	11	37.46±16.01		
Farmer	93	45.00±13.49		
Civil servant	7	39.29±18.09	1.539※	0.183
Businessman	4	39.00±7.66		
Retired	6	41.83±10.50		
Other	7	53.14±10.76		
Severity of snakebite				
Not poisoned	36	35.083±11.927		
Mild	48	41.208±9.854	28.646※	<0.001
Moderate	35	52.829±10.537		
Severe	9	63.889±7.184		
Swelling degree grading				
0 point	12	28.083±10.247		
1 point	57	41.193±11.999	20.962※	<0.001
2 points	48	47.833±10.765		
3 points	11	62.182±8.716		

Note: *=t; ※=F

directly proportional to the depth of snakebite, poisoning symptoms and increased pain intensity experienced by patients. This correlation may be attributed to the biochemical impact of snake venom and the release of cytokines, which activate pain receptors post-snakebite, resulting in heightened pain.[19] Furthermore, key brain regions such as the thalamus, basal ganglia, cerebellum, insula, anterior cingulate gyrus, and prefrontal cortex have been identified as critical areas

Table 4: Correlation analysis of variables associated with PTSD in individuals bitten by venomous snakes

Factors	PTSD (r value)
Pain score	0.484***
Psychological resilience scale	-0.552***
Objective support	-0.350***
Subjective support	-0.371***
Utilization of support	-0.389***
Total social support score	-0.525***

* p<0.05 ** p<0.01 *** p<0.001

involved in PTSD development. Pain experienced in the trunk region can alter the activity of these brain regions, influencing PTSD progression.[20,21]

From the results of the study, it could be seen that higher degrees of swelling, severity of venomous snakebite, and pain intensity were associated with an elevated risk of PTSD. This finding is consistent with prior research conducted by Yan *et al*. and supported by Xue's study, suggesting that increased injury severity and pain levels contribute to more pronounced PTSD symptoms.[22,23]

Venomous snakebites introduce toxins containing hyaluronidase, collagenase, protease, and phospholipase, triggering an inflammatory response and local tissue damage manifesting as swelling and pain. Swelling typically extends from the bite site and may lead to blisters and tissue necrosis.[24] As the severity of snakebite and swelling increases, so does the pain score and the severity of PTSD symptoms experienced by patients. This heightened experience of pain may exacerbate patients' perception of their condition as incurable, leading to decreased confidence in treatment and heightened nervousness and anxiety.[25] Thus, it is recommended that nursing

Table 5: Results of linear regression analysis on factors influencing PTSD in patients bitten by venomous snakes (n = 128)

	Unstandardized coefficient		Standardized coefficient	t	p	Covariate diagnosis	
	B	Standard error	Beta			VIF	Tolerance
Constant	58.570	5.590	-	10.478	<0.001***	-	-
Literacy	-2.980	0.851	-0.192	-3.504	0.001***	1.022	0.978
Pain score	1.667	0.373	0.274	4.470	<0.001***	1.285	0.778
Severity of snakebite	3.294	1.169	0.221	2.817	0.006**	2.107	0.475
Swelling degree grading	2.694	1.268	0.156	2.124	0.036*	1.840	0.543
Psychological resilience scale	-0.864	0.260	-0.211	-3.323	0.001**	1.383	0.723
Total social support score	-0.816	0.209	-0.252	-3.907	<0.001***	1.421	0.704
R^2	0.646						
Adjustment R^2	0.629						
F	F (6,121)=36.850, p<0.001						
D-W value	1.680						

Dependent variable: PTSD; * *p<0.05 ** p<0.01 *** p<0.001*

staff carefully monitor patients' pain levels and promptly implement effective interventions to alleviate pain.

The lower the literacy level, the higher the incidence of PTSD in patients bitten by venomous snakes

The study findings indicated that patients with different literacy levels exhibited significant differences in TSD levels. Specifically, individuals with lower literacy levels demonstrated a higher incidence of PTSD, consistent with the results reported by Liang *et al*.[26] This correlation suggests that patients with limited education may face challenges in accessing and comprehending information related to their condition, leading to heightened concerns about the prognosis of venomous snakebites. Consequently, healthcare providers should prioritize the dissemination of pertinent knowledge and education during the treatment process to address these informational gaps.

The higher the psychological resilience, the lower the incidence of PTSD in snakebite patients

Psychological resilience, also referred to as toughness or elasticity, denotes an individual's ability to maintain normal psychological and physiological functioning in the face of stress, adversity, trauma, or frustration.[27] The study findings revealed a negative correlation between the severity of PTSD symptoms in patients and their level of psychological resilience. Specifically, patients with lower psychological resilience exhibited more severe PTSD symptoms, consistent with previous research.[28]

The majority of patients in this study were farmers with limited financial resources, as indicated by their enrollment in rural health insurance and low family income. The financial burden associated with medical expenses such as treatment and rehabilitation, temporary loss of labor, and reduced workforce due to venomous snakebites significantly impacted their finances, contributing to heightened psychological pressure and the development of severe PTSD symptoms.[29] Thus, it is imperative to provide psychological support to patients during their initial care, encouraging them to express their emotions so that their PTSD levels can go down. Additionally, optimizing and enhancing the green channel at snakebite centers can alleviate patients' overall burden and facilitate their recovery.

The higher the utilization of social support, the lower the incidence of PTSD in snakebite patients

Social support encompasses both psychological and material resources available to individuals through interpersonal networks, aiding in disease prevention, mental health promotion, and overall well-being.[30,31] Social support utilization refers to patients' capacity to effectively utilize both objective and subjective support to facilitate recovery from adverse events. The study findings revealed a negative correlation between social support utilization and patients' PTSD symptoms, indicating that higher utilization of social support could mitigate PTSD symptoms following a venomous snakebite, consistent with prior research by Johansen *et al*.[32] Emotional and informational support resources may offer a comprehensive understanding of the event, aiding individuals in coping with its aftermath and mitigating the adverse effects of PTSD.

In conclusion, the findings of this study highlight the presence of PTSD among patients afflicted with venomous snakebites, with various factors such as pain severity, literacy level, psychological resilience, and social support utilization influencing its onset. Positive correlations were observed between PTSD symptoms and the severity of snakebite, degree of swelling, and pain scores. Conversely, patients with higher psychological resilience, greater literacy levels, and robust social support networks demonstrated lower incidences of PTSD.

It is recommended that healthcare professionals routinely screen patients with venomous snakebites for PTSD to facilitate early detection and timely intervention. Tailored treatment approaches, combining medication and psychotherapy, should be employed for patients diagnosed with PTSD to mitigate psychological distress. Limitations of this study include a small sample size due to resource constraints, a geographically confined study scope, and a lack of long-term monitoring of PTSD symptoms, potentially influencing the study's outcomes. Future research endeavors could focus on expanding the sample size, conducting cross-sectional investigations across multiple regions and centers, and implementing longitudinal follow-up assessments of PTSD patients.

DISCLOSURE

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