

# Psychological status of patients with amputation injury and effects of psychological interventions based on magnetic resonance imaging and X-ray characteristics

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**Summary. Background.** To explore the psychological status of patients with amputation injury and to evaluate the effects of psychological interventions based on magnetic resonance imaging (MRI) and X-ray characteristics. **Methods.** Two hundred patients admitted from June 2016 to May 2019 were randomly assigned into control and observation groups (n=100). Routine care was performed for both groups, based on which observation group was given psychological interventions. Coping style, compliance to examinations, mental stress, degree of perceived control, degree of anxiety, degree of depression, incidence rate of adverse events, and satisfaction with nursing services were compared. **Results.** After interventions, the score of positive coping, score of compliance to examinations and Control Attitudes Scale-Revised (CAS-R) score were significantly higher, whereas the score of negative coping, Chinese perceived stress scale (CPSS) score, self-rating anxiety scale (SAS) score and self-rating depression scale (SDS) score were lower in observation group than those in control group. The score of positive coping, score of compliance to examinations and CAS-R score were significantly elevated, while the score of negative coping, CPSS score, SAS score and SDS score reduced in both groups (p<0.05). The satisfaction rate was significantly higher in observation group than that in control group (p<0.05). The incidence rate of these adverse events was significantly lower in observation group than that in control group (p<0.05). **Conclusion.** Psychological interventions before MRI and X-ray examinations are conducive to adjustment of the mental state of patients receiving replantation of a severed limb, thus improving the compliance to examinations, completion rate and image quality.

**Key words.** Magnetic resonance imaging, psychological intervention, psychological status, X-ray.

## Introduction

Enhanced computed tomography (CT) means performing X-ray after injecting a contrast agent into patients, helping the doctor choose the viewing area. Then anatomic images are viewed on the com-

*Stato psicologico dei pazienti con lesione da amputazione ed effetti degli interventi psicologici basati sulla risonanza magnetica e sulle caratteristiche dei raggi X.*

**Riassunto. Introduzione.** Esplorare lo stato psicologico dei pazienti con lesioni da amputazione e valutare gli effetti degli interventi psicologici basati sulla risonanza magnetica (MRI) e sulle caratteristiche dei raggi X. **Metodi.** Duecento pazienti ricoverati da giugno 2016 a maggio 2019 sono stati assegnati in modo casuale a gruppi di controllo e osservazione (n=100). L'assistenza di routine è stata eseguita per entrambi i gruppi, in base al gruppo di osservazione che ha ricevuto interventi psicologici. Sono stati confrontati lo stile di coping, la compliance agli esami, lo stress mentale, il grado di controllo percepito, il grado di ansia, il grado di depressione, il tasso di incidenza degli eventi avversi e la soddisfazione per i servizi infermieristici. **Risultati.** Dopo gli interventi, il punteggio di coping positivo, il punteggio di compliance agli esami e il punteggio CAS-R (Control Attitudes Scale-Revised) erano significativamente più alti, mentre il punteggio di coping negativo, punteggio della scala cinese dello stress percepito (CPSS), ansia di autovalutazione il punteggio della scala (SAS) e il punteggio della scala di autovalutazione della depressione (SDS) erano inferiori nel gruppo di osservazione rispetto a quelli del gruppo di controllo. Il punteggio di coping positivo, il punteggio di compliance agli esami e il punteggio CAS-R erano significativamente elevati, mentre il punteggio di coping negativo, il punteggio CPSS, il punteggio SAS e il punteggio SDS si sono ridotti in entrambi i gruppi (p<0,05). Il tasso di soddisfazione era significativamente più alto nel gruppo di osservazione rispetto a quello del gruppo di controllo (p<0,05). Il tasso di incidenza di questi eventi avversi era significativamente inferiore nel gruppo di osservazione rispetto a quello del gruppo di controllo (p<0,05). **Conclusione.** Gli interventi psicologici prima della risonanza magnetica e degli esami radiografici favoriscono l'adeguamento dello stato mentale dei pazienti che ricevono il reimpianto dell'arto reciso, migliorando così la compliance agli esami, il tasso di completamento e la qualità dell'immagine.

**Parole chiave.** Intervento psicologico, raggi X, risonanza magnetica, stato psicologico.

puter by which three-dimensional images are constructed using collected data<sup>1</sup>. Magnetic resonance imaging (MRI) technique refers to using atomic nuclei to resonate in a magnetic field to generate signals and reconstruct images, with high resolution for soft tissues, which is able to identify the lo-

cation and features of foci by increasing the contrast between diseased tissues and normal tissues through injection of a contrast agent into patients<sup>2</sup>. Both CT and MRI have become common methods in clinical examinations as medical technology develops, which can be used in the examination of bone, soft tissues and nerves, with a wide field of application<sup>3</sup>. However, these methods require a long time for examination, so patients have to stay in a confined space for a long time. Besides, there is a relatively loud noise during scans, which, together with the discomfort caused by the contrast agent injected, can easily make patients have negative emotions including tension and anxiety, negatively affecting the examinations. For these reasons, patients are often given psychological nursing to some extent before undergoing CT and MRI examinations in clinical practice.

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## Objectives

To explore the effects of psychological interventions, in this study, 200 patients undergoing replantation of a severed limb and CT and MRI examinations admitted to our hospital from June 2016 to May 2019 were enrolled for a comparative study to analyze and summarize the psychological conditions and psychological interventions of patients receiving enhanced CT and MRI scans, providing a certain theoretical basis for clinical application.

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## Population and methods

Two hundred patients undergoing replantation of a severed limb, who received CT and MRI examinations in our hospital from June 2016 to May 2019, were enrolled and assigned into control and observation groups (n=100) using a random number table. In observation group, there were 48 females and 52 males aged 17-55 years old, with a mean of 37.83±12.66 years old, and high-quality nursing and proper psychological interventions were given. In control group, there were 43 males and 57 females aged 18-54 years old, with an average of 36.55±11.08 years old, and routine care was adopted.

The inclusion criteria were set as follows: 1) patients with clear consciousness and no cognitive impairment and language impairment; 2) non-pregnant or -breastfeeding women; 3) those without other organ dysfunction; 4) those without contraindications for CT and MRI; 5) those able to undergo replantation; 6) those with a relatively complete severed limb and a high success rate of replantation; and 7) those with the severed limb ischemia at room temperature for <6 h. The exclusion criteria involved: 1) patients with acute infection or shock; 2) those with

severe cardiovascular diseases; severe organ damage or malignant tumors; 3) those with mental disorders; 4) those with a history of depression, anxiety or other diseases; 5) those who were taking antidepressants, anti-anxiety drugs, or mood stabilizers; or 6) those who quit midway. This study was reviewed by the Medical Ethics Committee of our hospital, and all patients signed the informed consent.

The clinical data of the 200 subjects were sorted out in detail and analyzed retrospectively, and their psychological characteristics were summarized.

Routine care was adopted in control group. Before examinations, patients were carefully asked whether they have metallic implants and asked to take adequate rest. They were not allowed to enter the examination room if wearing metal accessories. Besides, they were fasted for 4-8 h and taught the correct breath-holding method before examinations. During examinations, patients breathed evenly and could hold their breath for 15 s. Then a large and straight vein with rich blood volume was chosen for puncture. Thereafter, a cotton ball was used to press the puncture point to avoid local bleeding. After examinations, patients were guided to drink plenty of water to facilitate the rapid discharge of the contrast agent.

In addition to the same routine care as that in control group, psychological interventions were carried out in observation group, including:

1. *Mental status assessment.* The mental status of patients was assessed using the Self-rating Anxiety Scale (SAS) and Self-rating Depression Scale (SDS). The score greater than 7 points suggested anxiety and depression in patients. Besides, the psychological pressure of patients was evaluated through the Chinese Perceived Stress Scale (CPSS), and the reasons for the psychological pressure and negative emotions of patients were analyzed<sup>4</sup>.

2. *Cognitive reconstruction.* The true thoughts of patients were understood through communication with them patiently, and incorrect cognitions of patients and their causes were analyzed. Senior nurses were asked to perform cognitive interventions on patients, and explain the reasons for CT and MRI examinations and possible discomforts as well as corresponding coping methods to improve patients' understanding of CT and MRI examinations. In addition, patients were informed of the effects of incorrect cognitions on their physical and mental health, and helped to rebuild their correct cognition.

3. *Psychological support.* Nurses actively understood the physical and psychological needs of patients, established a good nurse-patient relationship with patients, helped patients vent their psychological pressure through empathy at the right time, encouraged patients with empathy and gave psychological support.

4. *Emotional intervention.* Patients were guided to adjust their habitual anxiety, tension and other negative emotions through exercise therapy, music therapy and other methods, gradually improving their mental state.

5. *Behavioral intervention.* A): exposure therapy. Before examinations, patients were arranged to visit CT and MRI scanners and observe the examination process of other patients, and informed of that CT and MRI will not discomfort and harm the body. B): distraction. During examinations, patients were guided to distract attention by chewing food and listening to music.

6. *Social support.* To reduce the nervousness and fear of patients, a relative or friend could be allowed to accompany patients to increase the patients' sense of security.

At admission, patients were carefully asked about the occupation (manual worker or mental worker), marital status (unmarried or married), education level (senior high school or below, or senior high school or above) and nature of amputation (cutting, rolling, squeezing, tearing or other).

After scans, patients were asked about the psychological problems (distrust, self-doubt, psychology of anxiety and fear, and psychological reactance) in undergoing CT and MRI scans, and these problems were sorted out.

The coping style of patients was assessed using the Trait Coping Style Questionnaire (TCSQ) before and after interventions. The scale has 20 items covering two dimensions, namely positive coping and negative coping, in total, using the 5-level (1-5 points) scoring method, with a score of 10-50 points<sup>5</sup>.

A self-made questionnaire was used to evaluate the compliance of patients before and after interventions, with a score of 0-100 points, and the score is proportional to the compliance.

The mental stress of patients was evaluated using the CPSS before and after interventions. CPSS includes 2 dimensions (tension and sense of out of control) and a total of 14 items, using the 7-level (1-7 points) scoring method, with a score of 14-98 points, and the score is proportional to the psychological stress (4).

The Control Attitudes Scale-Revised (CAS-R) was adopted to assess the degree of perceived control of patients before and after intervention, which covers a total of 8 dimensions, using the 5-level (1-5 points) scoring method, with a score of 8-40 points, and the score is proportional to the degree of perceived control<sup>6</sup>.

The mental state was evaluated using SAS and SDS<sup>7,8</sup>. A high SAS score indicates severer anxiety, and a high SDS score suggests severer depression.

The adverse events that occurred during exami-

nations were recorded and counted. After examinations, patients were asked about their satisfaction with nursing services.

SPSS 20.0 software was used for statistical analysis. Measurement data were expressed as (mean  $\pm$  standard deviation) and compared using paired-sample *t* test within groups and independent-sample *t* test between groups. For numerical data,  $\chi^2$  test was employed.  $P < 0.05$  indicated that difference was statistically significant.

## Results

The major psychological problems found in 200 patients undergoing CT and MRI scans were distrust, self-doubt, psychology of anxiety and fear, and psychological reactance (Table 1).

The general data of patients showed no significant differences between the two groups ( $p < 0.05$ ) (Table 2).

Before interventions, the coping style and compliance to examinations of patients had no significant differences between the two groups ( $p > 0.05$ ). After interventions, the score of positive coping and score of compliance to examinations were significantly higher in observation group than those in control group, whereas the score of negative coping was significantly lower in observation group than that in control group. Compared with those before interventions, the score of positive coping and score of compliance to examinations were significantly elevated, while the score of negative coping was significantly reduced in both groups after interventions ( $p < 0.05$ ) (Table 3).

There was no significant difference in the CPSS score between the two groups before interventions ( $p > 0.05$ ). After interventions, the CPSS score was significantly lower in observation group than that in control group. Compared with that before interventions, the CPSS score significantly declined in both groups after interventions ( $p < 0.05$ ) (Table 4).

No significant differences were found in the SAS, SDS and CAS-R scores between the two groups before interventions ( $p > 0.05$ ). After interventions, in contrast with control group, observation group had

**Table 1.** Psychological analysis results of patients undergoing CT and MRI scans [n (%)].

Psychological problem	n	%
Distrust	9	4.50
Self-doubt	88	44.00
Psychology of anxiety and fear	132	66.00
Psychological reactance	39	19.50

**Table 2.** General data [n=100, n (%)].

	Observation group	Control group	$\chi^2$	p
Occupation	-	-	0.515	0.473
Manual worker	61 (61.00)	56 (56.00)		
Mental worker	39 (39.00)	44 (44.00)		
Marital status	-	-	0.977	0.323
Married	89 (89.00)	93 (93.00)		
Unmarried	11 (11.00)	7 (7.00)		
Education level	-	-	3.458	0.063
Senior high school or below	51 (51.00)	64 (64.00)		
Senior high school or above	49 (49.00)	36 (36.00)		
Nature of amputation	-	-	0.429	0.572
Cutting	24 (24.00)	23 (23.00)		
Rolling	38 (38.00)	38 (38.00)		
Squeezing	20 (20.00)	19 (19.00)		
Tearing	10 (10.00)	13 (13.00)		
Others	8 (8.00)	7 (7.00)		

significantly decreased SAS and SDS scores and an obviously increased CAS-R score. Compared with those before interventions, the SAS and SDS scores were significantly reduced, whereas the CAS-R score significantly rose in both groups after interventions ( $p<0.05$ ) (Table 5).

The satisfaction rate of patients with nursing

services was markedly higher in observation group than that in control group (96.% vs 85.%,  $p<0.05$ ) (Table 6).

Such adverse events as palpitation, headache, motion artifact and refusal to undergo examinations were found in both groups during examinations. The incidence rate was 2% in observation group, significantly

**Table 3.** Coping style and compliance to examinations before and after intervention [n=100,  $\chi \pm s$ , point (s)]

	Observation group	Control group	$t_{\text{between groups}}$	$P_{\text{between groups}}$
Positive coping	-	-	0.510	0.611
Before interventions	21.87±4.58	22.24±5.63	9.923	<0.001
After interventions	35.16±5.46*#	27.92±4.84*		
$t_{\text{within groups}}$	18.649	7.650		
$P_{\text{within groups}}$	<0.001	<0.001		
Negative coping	-	-	0.770	0.442
Before interventions	32.38±4.04	32.86±4.75	16.452	<0.001
After interventions	17.57±3.12*#	25.71±3.84*		
$t_{\text{within groups}}$	29.014	11.706		
$P_{\text{within groups}}$	<0.001	<0.001		
Compliance to examinations	-	-	0.469	0.640
Before interventions	72.08±7.14	72.53±6.41	7.038	<0.001
After interventions	89.65±5.33*#	83.18±7.49*		
$t_{\text{within groups}}$	19.719	10.803		
$P_{\text{within groups}}$	<0.001	<0.001		

\* $p<0.05$  vs before interventions within groups, # $p<0.05$  vs control group after interventions.

lower than that (11%) in control group, and the difference was of statistical significance ( $p < 0.05$ ) (Table 7).

### Discussion

Currently, CT and MRI scans have been widely applied to diagnose various diseases, through which foci are mainly determined based on the difference

between surrounding normal tissues and diseased tissues, and the nature and scope of foci are obtained, providing reference for clinical diagnosis and treatment. To increase the definition of focal zones, a contrast agent should be injected into patients, improving diagnostic accuracy. However, this process will cause pain to patients, and patients need to stay in a small and confined space and bear a loud noise

**Table 4.** Mental stress before and after interventions [n=100,  $\chi \pm s$ , point (s)].

	Observation group	Control group	$t_{\text{between groups}}$	$P_{\text{between groups}}$
Tension	-	-		
Before interventions	31.76±2.95	31.57±2.63	0.481	0.631
After interventions	15.27±2.17 <sup>#</sup>	20.36±2.35*	15.913	<0.001
$t_{\text{within groups}}$	45.028	31.784		
$P_{\text{within groups}}$	<0.001	<0.001		
Sense of out of control	-	-		
Before interventions	30.17±3.36	30.28±3.15	0.239	0.811
After interventions	16.28±4.02 <sup>#</sup>	21.55±3.73*	9.610	<0.001
$t_{\text{within groups}}$	26.511	17.881		
$P_{\text{within groups}}$	<0.001	<0.001		
Total points	-	-		
Before interventions	61.93±6.64	61.85±5.60	0.092	0.927
After interventions	31.55±5.13 <sup>#</sup>	41.91±4.25*	15.551	<0.001
$t_{\text{within groups}}$	36.206	28.364		
$P_{\text{within groups}}$	<0.001	<0.001		

\* $p < 0.05$  vs before interventions within groups; <sup>#</sup> $p < 0.05$  vs control group after interventions.

**Table 5.** Unhealthy emotions before and after interventions [n=100,  $\chi \pm s$ , point (s)].

	Observation group	Control group	$t_{\text{between groups}}$	$P_{\text{between groups}}$
SAS score	-	-		
Before interventions	41.77±8.21	41.86±8.17	0.078	0.938
After interventions	9.53±4.15 <sup>#</sup>	17.45±4.60*	12.784	0.000
$t_{\text{within groups}}$	35.046	26.035		
$P_{\text{within groups}}$	<0.001	<0.001		
SDS score	-	-		
Before interventions	42.27±8.94	41.88±9.02	0.307	0.759
After interventions	8.93±6.36 <sup>#</sup>	20.02±7.84*	10.985	<0.001
$t_{\text{within groups}}$	30.388	18.291		
$P_{\text{within groups}}$	<0.001	<0.001		
CAS-R score	-	-		
Before interventions	18.58±1.52	18.26±1.36	1.569	0.118
After interventions	24.06±1.63 <sup>#</sup>	21.13±1.45*	13.430	<0.001
$t_{\text{within groups}}$	24.588	14.437		
$P_{\text{within groups}}$	<0.001	<0.001		

\* $p < 0.05$  vs before interventions within groups; <sup>#</sup> $p < 0.05$  vs control group after interventions.



**Table 6.** Nursing efficacy [n=100, n (%)].

	Very satisfied	Satisfied	Dissatisfied	Overall satisfaction	$\chi^2$	<i>p</i>
Observation group	72 (72.00)	24 (24.00)	4 (4.00)	96 (96.00)	7.037	0.008
Control group	51 (51.00)	34 (34.00)	15 (15.00)	85 (85.00)	-	-

**Table 7.** Adverse events during examinations [n=100, n (%)].

	Headache	Palpitation	Motion artifact	Refusal to undergo examination	Total incidence rate	$\chi^2$	<i>p</i>
Observation group	1 (1.00)	0 (0.00)	1 (1.00)	0 (0.00)	2 (2.00)	6.664	0.010
Control group	2 (2.00)	4 (4.00)	4 (4.00)	1 (1.00)	11 (11.00)		

during CT and MRI examinations. As a result, patients will have negative emotions such as tension and fear directly caused by CT and MRI equipment structure and examination environment<sup>9</sup>. Besides, these negative emotions will be aggravated by patients' concern for their own conditions, thereby affecting the results of examinations. In this study, 200 patients with replantation of a severed limb who underwent CT and MRI scans in our hospital were selected, and the main psychological problems of patients during scans were counted and analyzed. The results showed that during CT and MRI scans, psychology of anxiety and fear, self-doubt, psychological reactance and distrust were found in 132 (66%), 88 (44%), 39 (19.5%) and 9 (4.5%) patients, respectively, in line with the findings of the research conducted by Tan<sup>10</sup>.

Anxiety refers to the psychological reaction of patients who are fearful of poor examination results. The reason why patients have anxiety is that they have great mental stress from the machine and equipment and a panic due to the abnormal noise of the equipment, and worry about their severe illness and vast expense<sup>11</sup>. Self-doubt is mostly found in patients who need to undergo enhanced CT and MRI scans because the results of plain scan are abnormal. These patients can't understand why they need to receive enhanced scans after the plain scan has been completed, resulting in the psychology of anxiety and pessimism and a heavy burden of thought<sup>12</sup>. Patients with a low education level and poor social experience are skeptical of various imaging examinations, who believe that the implementation of CT and MRI scans in the hospital aims to create income, so they have psychological reactance and refuse examinations<sup>13</sup>. Distrust is manifested as no confidence and no cooperation, caused by patients' lack of understanding of CT and MRI scans, their belief that scans are necessary only when doctors have insufficient diagnostic

ability and lacked responsibility, and their fear of increasing medical expenses<sup>14</sup>.

Clinically, in routine care, only the condition of patients is focused on, and less attention is paid to the change of the psychological state of patients. In this study, therefore, psychological interventions were employed to relieve the psychological problems of patients during CT and MRI examinations. In this study, the 200 patients enrolled were divided into two groups using a random number table and given different nursing interventions, with routine care in control group and routine care + psychological interventions in observation group. The content of nursing mainly includes mental state assessment, cognitive reconstruction, psychological support, behavioral intervention and social support, offering patients scientific and effective nursing interventions during the entire examination process, which makes sure that they receive examinations under a stable psychological state regulated to ensure the accuracy of examination results<sup>15</sup>. The results of this study revealed that before interventions, there were no significant differences in coping style, compliance to examinations, and CPSS, SAS, SDS and CAS-R scores between the two groups of patients. After interventions, the positive coping score, score of compliance to examinations, and CAS-R score of patients significantly rose in the two groups, with higher scores in observation group than those in control group. Besides, the negative coping score, CPSS score, SAS score and SDS score of patients significantly declined in the two groups, with lower scores in observation group than those in control group. These results indicate that psychological interventions can effectively enhance the confidence of patients in overcoming difficulties, reduce their sense of loss of control, helplessness and mental stress, improve their compliance to examinations, relieve anxiety, depression and other negative emotions and improve perceived

control ability, thereby encouraging patients actively respond to CT and MRI examinations. Moreover, it was found in this study that the satisfaction rate of patients was 96.00% in observation group, significantly higher than that in control group (85%). In addition, the adverse events observed in the two groups of patients during examinations were palpitation, headache, motion artifact and refusal to undergo examinations, with a significantly lower incidence rate in observation group (2%) than that in control group (11%).

In conclusion, patients often have abnormal psychology when undergoing CT and MRI scans. Psychological interventions are capable of effectively alleviating the negative emotions of patients undergoing CT and MRI examinations, reducing their mental stress, and improving their ability of perceived control, thereby encouraging patients to actively respond to examinations.

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