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Associations among health-related quality of life, mental resilience and social support in patients early after surgery for osteoporotic vertebral compression fractures: a longitudinal study

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ABSTRACT

Objective This study aims to explore the profile of health-related quality of life (HRQoL) of postoperative osteoporotic vertebral compression fracture (OVCF) patients through a longitudinal investigation, especially in the early postoperative phase, discern the effect of mental resilience and social support on postoperative HRQoL and further explore the mechanisms by which mental resilience exerts influences on HRQoL.

Design This longitudinal observational study was conducted to examine the HRQoL of OVCF patients during the early postoperative period. Data collection occurred at three distinct time points: baseline assessment on postoperative day 1 (T1), followed by subsequent evaluations at 1 month (T2) and 3 months (T3) postsurgery.

Setting Zhoupu Hospital, in Shanghai, China.

Participants A total of 155 postoperative OVCF patients completed the baseline survey, with 150 and 140 participants completing the follow-up at T2 and T3.

Outcome measures Primary end-point variables were HRQoL, mental resilience and social support. Secondary end-point outcomes included demographic data and disease-related information.

Results The baseline data indicated that the average age of participants was 69.6 years, ranging from 53 to 92 years, with females accounting for 69.0%. There was no significant difference in demographic characteristics, such as age, gender and other factors, between the follow-up and the lost ($p>0.05$). Although the level of HRQoL, mental resilience and social support still remain at relatively lower levels at three separate times, they gradually elevated with time. Both mental resilience ($r=0.293$, $p<0.01$) and social support ($r=0.257$, $p<0.01$) demonstrated significant positive correlations with HRQoL. Multiple linear regression analysis at T3 identified smoking history ($\beta=-0.137$, $p<0.001$), gender ($\beta=-0.154$, $p<0.001$) and diabetes ($\beta=0.126$, $p=0.001$) as independent factors for postoperative HRQoL. Longitudinal mediation analysis suggests that social support exerted an indirect effect on HRQoL through mental resilience ($\beta=1.017$, $p<0.001$).

Conclusions Mental resilience and social support are strongly intertwined with HRQoL of OVCF patients after surgery in the early postoperative stage. Notably, social support exerts its beneficial effects on HRQoL through enhanced mental resilience in this critical postoperative period. Targeted interventions should be implemented to optimise social support networks and cultivate psychological resilience, which may substantially improve postoperative HRQoL outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Using a longitudinal approach allows for the tracking of patients' progress over time and examines the profile of health-related quality of life (HRQoL) during the early postoperative phase.
⇒ Employing longitudinal mediation research provides a comprehensive understanding of the relationship among HRQoL, mental resilience and social support compared with previous cross-sectional studies.
⇒ The sample is confined to a specific region and hospital, restricting the generalisability of the results.

INTRODUCTION

Osteoporotic vertebral compression fractures (OVCFs), clinically manifested as persistent pain, spinal deformities, compromised mobility, diminished pulmonary function, clinical depression and potential paralysis, collectively result in substantial deterioration of health-related quality of life (HRQoL).[1] OVCFs constitute a primary category of fragile fractures associated with osteoporosis, which exacerbates as age increases.[2] Approximately 50% of OVCF cases remain asymptomatic during initial stages, characterised by absent back pain and imaging modalities frequently failing to detect vertebral

compression fractures, thereby contributing to low clinical consultation rates.[3] The incidence of OVCFs is on the rise, ranging from 5.0% to 10.0% in individuals aged ≤80, while reaching 25.0%–50.8% in those aged over 85 years.[4] The expanding geriatric OVCF population presents substantial challenges to healthcare service, concurrently imposing considerable socioeconomic burdens.[5]

The mortality rate for OVCF patients was reported to be markedly higher compared with general population in a Chinese survey, with figures of 3.1% vs 1.6%.[6] Current therapeutic paradigms encompass both conservative management (pharmacotherapy, orthotic stabilisation) and surgical interventions (vertebroplasty, internal fixation). Despite the availability of a diverse array of treatment modalities, patients continue to face numerous challenges during the postoperative period.[3] While conservative management circumvents surgical trauma and associated stress responses, it demonstrates limited efficacy in correcting spinal deformities. In case of OVCF patients exhibiting progressive vertebral collapse, intravertebral fissures, pseudoarthrosis formation, spinal kyphosis, neurological dysfunction and other severe manifestations, surgical intervention could be seriously considered. Percutaneous vertebroplasty (PVP) has become the priority of clinical treatment of OVCFs, effectively relieving pain and recovering vertebral body height with minimal trauma and shortening recovery time since the invention in 1987.[7] Surgical approaches are presently considered the most efficacious modality with the objective of restoring vertebral alignment, promoting fracture healing, minimising complications and mortality and preventing recurrent fractures.[8] However, compromised physiological function and prolonged postoperative recovery may induce psychological distress. Postoperative HRQoL outcomes exhibit multifactorial determinants, encompassing demographic parameters, surgical complication profiles, procedural selection criteria and psychosocial determinants.[9] These adverse factors potentiate the vulnerability to psychological states, including anxiety and depression, ultimately impeding rehabilitation progress.[10]

Conceptualised as a dynamic psychosocial construct, mental resilience encompasses the adaptive capacity to successfully navigate adverse events, manage stressors and achieve functional recovery after traumatic experiences.[11] Enhancing mental resilience has a positive impact on patients' overall well-being, as it improves their ability to manage adverse emotions and experiences, ultimately enabling them to adeptly confront clinical treatment.[12 13] Robust social support systems could comprehensively attenuate psychological distress, facilitate affective regulation and enhance stress adaptability.[14] Among those numerous factors affecting mental resilience, social support has been identified as one of the significant contributors.[15] Positive psychology refers to the ability to adapt positively to the challenges in the external environment when confronting negative events such as trauma, which can activate psychological resources to manage the stress in a positive way. We assume that mental resilience mediates the effect of social support on life quality based on the concept of positive psychology.[16]

While previous investigations have primarily evaluated HRQoL during clinical interventions and/or long-term postoperative survival phases,[17 18] current policy initiatives aim to address the escalating incidence of OVCFs. Nevertheless, a paucity of research in the Chinese context has systematically examined the influence of psychological resilience and social support on HRQoL among surgically treated OVCF patients, particularly regarding quality-of-life fluctuations within the critical 3-month postoperative window. The purpose of this study was (a) to examine the profile of HRQoL during the early postoperative phase, (b) to discern the effect of mental resilience and social support on postoperative HRQoL and investigate the underlying mechanisms mediating these relationships. The anticipated findings help inform targeted interventions to optimise patient well-being and advance evidence-based healthcare strategies for postoperative OVCFs management.

METHODS

Study design and participants

A longitudinal follow-up study was conducted to investigate the HRQoL in individuals early after surgical treatment for OVCFs. A total of 155 patients having PVP for symptomatic OVCFs participated in the initial survey (T1). Subsequently, participants were invited to complete the same questionnaires at 1 month (T2) and 3 months (T3) after the baseline data collection. One participant did not complete the questionnaire due to a serious health condition, and four participants withdrew from the study due to loss of interest (T2, n=150). In the next phase of the investigation, a total of 140 individuals completed the T3 questionnaire. Two participants were unable to continue due to health issues, and eight individuals withdrew at T3 because of lack of interest (figure 1). Reminder calls were made to ensure whether those participants had completed the follow-up questionnaires. All participants were recruited from Zhoupu Hospital, affiliated with SUMHS in China, between 1 April 2023 and 30 September 2023. Questionnaires were distributed to patients 1 day after OVCFs surgery (at baseline, T1), and follow-up was subsequently conducted via outpatient examinations, telephone interviews, two-dimensional coded questionnaire surveys and inpatient re-examinations at 1 month (T2) and 3 months postsurgery (T3).

In this study, the inclusion criteria were as follows: (1) participants were over 50 years of age, possessed reading and writing abilities and were capable of communication; (2) participants had been diagnosed with OVCFs and were confirmed to have undergone surgical treatment; (3) participants exhibited complete cognitive and behavioural abilities and (4) participants voluntarily participated in this study and provided written informed consent. The exclusion criteria were as follows: (1)

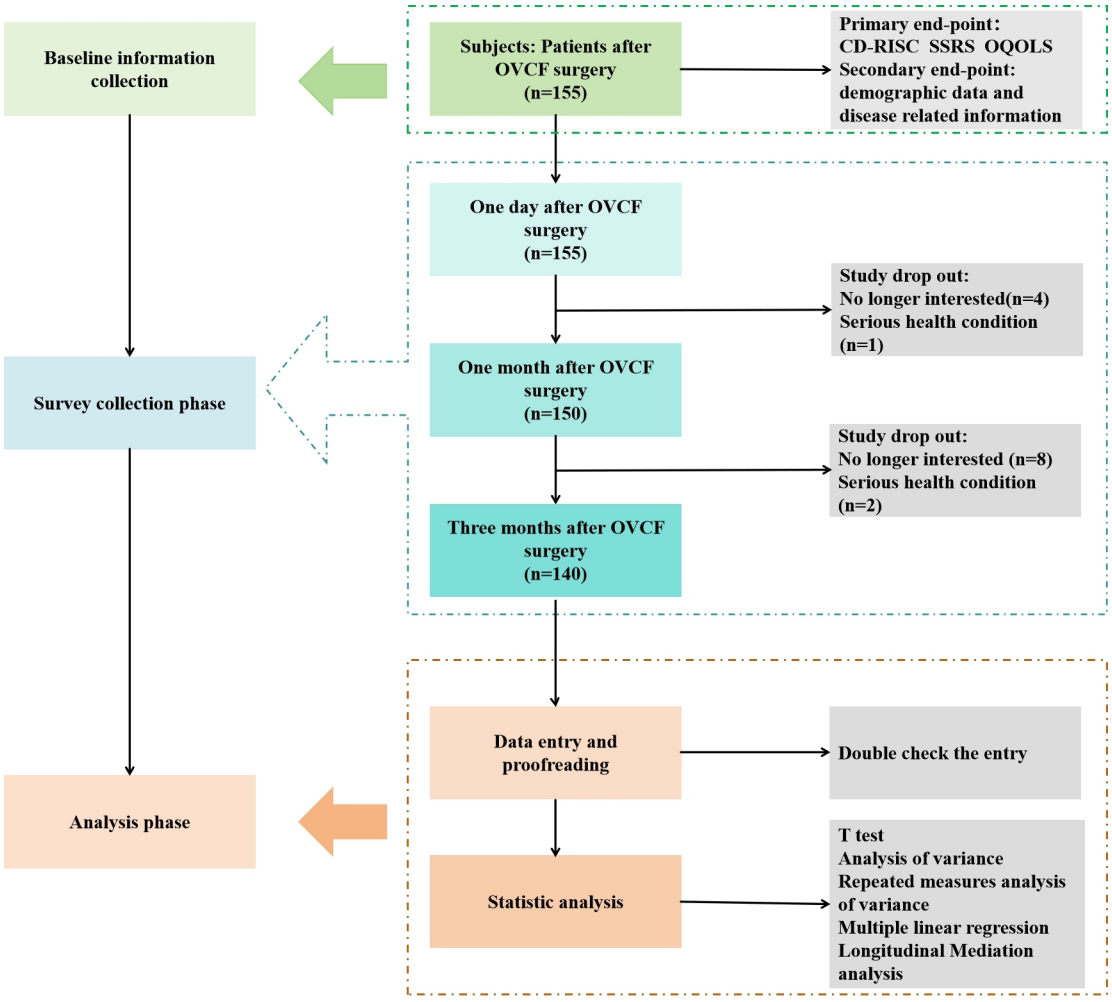

Figure 1 Study flow diagram. CD-RISC, Connor-Davidson Resilience Scale; OQOLS, Osteoporosis Quality of Life scale, OVCF, osteoporotic vertebral compression fracture; SSRS, Social Support Rate Scale.

patients with secondary vertebral fracture caused by infection, tumour or other factors; (2) patients with vertebral fracture resulting from severe high-energy trauma (due to osteoporosis having less impact); (3) patients with neurological defects associated with OVCFs and (4) patients with a history of other diseases that significantly affect HRQOL, such as malignant tumours or severe cardiopulmonary diseases.

Written informed consent regarding voluntary participation was obtained from all eligible patients prior to their completion of the structured questionnaires.

Patient and public involvement

In our longitudinal study on OVCFs postoperative outcomes, patient and public involvement was integral from the initial conceptualisation stage. A focus group with patients was involved in discussions, being informed about the development of study design, research questions and outcome measures. Patient representatives provided ongoing feedback, ensuring a patient-centred approach. Patients have been willing to participate in the follow-up and throughout the study (online supplemental file 3). Their input ensured the relevance, feasibility and acceptability of the study. By sharing findings through preferred formats and channels, we aim to enhance the impact and reach of our research, ultimately benefiting the wider patient community.

Data sources and instruments

A total of four instruments were employed in the study. The first one collected demographic data and clinical information. The Osteoporosis Quality of Life scale (OQOLS) was used to examine life quality. The Social Support Rate Scale (SSRS) and Connor-Davidson Resilience Scale (CD-RISC) were employed to investigate the profile of social support and mental resilience among patients with OVCFs.

Demographic data and disease information

The demographic data comprised age, gender, educational level, marital status, income, employment status, knowledge about the operation, medical fee payment and family-residence relationship. In addition to body mass index and comorbidities, the disease information encompassed (1) the presence of one or multiple vertebral fractures; (2) history of antiosteoporosis medication use; (3)

history of fractures (including hip, spine, elbow or wrist) prior to the occurrence of OVCF; (4) chronic diseases (such as hypertension, diabetes, cerebrovascular accident, coronary heart disease or chronic obstructive pulmonary disease) and (5) preoperative fracture vertebra: thoracolumbar (T11–L2) or non-thoracolumbar level.

Social Support Rate Scale

Social support was assessed using the Chinese version of the SSRS, which consists of three dimensions: utilisation of support, subjective support and objective support.[19] Total scale scores range from 12 to 66. Based on prior threshold scores, the totals ≥49 indicate high social support, the scores between 49 and 17 represent medium support and the totals ≤17 reflect low support. Cronbach's α was 0.708.

Connor-Davidson Resilience Scale

The scale consists of 25 items with 3 dimensions: tenacity (14 items), strength (7 items) and optimism (4 items). The study employed a 5-point scoring system, presenting a total score range of 0 to 100. A higher score is indicative of a greater degree of mental resilience. A score of less than 56 points indicates a low resilience level; a score between 57 and 70 points suggests a medium resilience level, whereas a score between 71 and 100 points indicates a high resilience level. In the present study, the CD-RISC exhibited excellent internal consistency, with a Cronbach's α of 0.91.[20]

Osteoporosis Quality of Life Scale

This questionnaire assesses the diverse dimensions of HRQoL among individuals with primary osteoporosis. This 75-item questionnaire uses a 5-point Likert scale ranging from 1 (none at all) to 5 (very serious). The questionnaire consists of five function scales (disease dimension, physiological dimension, psychological dimension, social dimension and satisfaction dimension). A positive correlation is observed between higher OQOLS scores and improved HRQoL. The OQOLS, which integrates a suitable general scale with a disease-specific scale, demonstrates sensitivity to variations in patients' health status. The OQOLS presents excellent overall internal reliability (Cronbach's α=0.981) and good subscale reliability (0.873–0.967). Factor analysis supports the structural validity of the OQOLS.[21]

Statistical analyses

The demographic data and clinical characteristics were summarised as the means and SDs for continuous variables, and as frequency counts with percentages for categorical variables. Repeated measures analysis of variance (ANOVA) was used to examine changes in HRQoL, mental resilience and social support across three time points (T1–T3). ANOVA was also employed to examine associations between demographic characteristics and potential factors and HRQoL. Variables demonstrating significant associations with HRQoL in univariate analyses, such as demographics, disease characteristics, mental resilience and social support, were incorporated into a multiple linear regression model to identify predictors of HRQoL. Missing data were imputed using series means.

A cross-lagged model was evaluated through structural equation modelling using AMOS version 24 with maximum likelihood estimation. Model fit was evaluated using: χ^2/df ratio, standardised root mean square residual (SRMR), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA) and comparative fit index (CFI).[22 23] According to the recommendation of the acceptable model index, adequate fit is indicated by TLI and CFI>0.95, SRMR and RMSEA<0.05 and χ^2/df ratio <5.0.

Mediation effects tested using the PROCESS macro for SPSS with 5000 bootstrap resamples to estimate indirect effects and 95% bias-corrected CIs. Statistical significance was determined as p<0.05. Analyses were performed using SPSS V.26.0.

RESULTS

Participant features

Baseline characteristics of 155 participants are shown in table 1. The sample comprised 107 female participants (69.0%). The mean age of the participants was 69.6 years, ranging from 53 to 92 years. No significant differences were found in demographic characteristics, including age, gender and other factors, between the followed up participants and the lost (p>0.05).

The univariate analysis of demographic data revealed significant differences in gender, age, monthly income and smoking history among patients with statistical significance (p<0.05). Similarly, the univariate analysis of patients' clinical data demonstrated significant disparities in the number of comorbidities, diabetes status and the level of antiosteoporosis treatment among patients, achieving statistical significance (p<0.05). The details are presented in the online supplemental table 1.

Primary outcome

Correlation analysis among mental resilience, social support and HRQoL

The correlations among mental resilience, social support and HRQoL are presented in online supplemental table 2 and figure 2. Significant correlations were revealed among mental resilience, social support and HRQoL across all time intervals. Mental resilience was detected to have a positive correlation with social support (r=0.499, p<0.01) and HRQoL (r=0.293, p<0.01) at T1. Total social support was also significantly correlated with HRQoL scores. Notably, social support scores exhibited exceptionally high temporal stability, with the strongest correlation between T2 and T3 measurements (r=0.957, p<0.01). During the observational time, the pairwise correlations between the variables showed statistical significance, and these correlations also exhibited a positive trend (p<0.01). Improved mental resilience leads to enhanced

Table 1 Baseline information of the participants in the study

Variable	n	Percentage (%)	P value
Gender			0.451
Males	48	31.0	
Females	107	69.0	
Age			0.652
50–60	33	21.3	
60–70	52	33.5	
70–80	50	32.3	
80+	20	12.9	
Educational background			0.124
Primary school and below	37	23.9	
Junior high school	49	31.6	
High school or technical secondary school	52	33.5	
(College for) professional training	13	8.4	
Undergraduate course	4	2.6	
Working condition			0.660
No work	2	1.3	
Working	25	16.1	
Retired	128	82.6	
Marital status			0.072
Married	151	97.4	
Bereft of one's spouse	4	2.6	
Dwelling state			0.321
Living alone	47	30.3	
Live with family	108	69.7	
Payment methods for medical expenses			0.053
Urban medical insurance	103	66.5	
Self-paying	52	33.5	
Monthly income			0.188
<2000/month	12	7.7	
2000–3999/month	42	27.1	
4000–5999/month	64	41.3	
6000–7999/month	37	23.9	
History of smoking			0.520
Non-smoking	132	85.2	
Smoking	23	14.8	
History of drinking			0.220
Non-drinking	136	87.7	
Drinking	19	12.3	
Movement situation			0.441
Yes	76	49.0	
No	79	51.0	
Number of comorbidities			0.356
0	77	49.7	
1	55	35.5	
2	20	12.9	
3	3	1.9	
Hypertension			0.076
Yes	70	45.2	
No	85	54.8	
Diabetes			0.053
Yes	27	17.4	
No	128	82.6	
BMI (kg/m^2)			0.076
<18.5	2	0.6	
18.5–23.9	64	41.4	
24–27.9	82	53.5	
28–32	7	4.5	
Fracture segment			0.088
Antiosteoporotic therapy	120	77.4	
Multiple segments	35	22.6	
Antiosteoporotic therapy			0.075
Yes	137	88.4	
No	18	11.6	

BMI, body mass index.

HRQoL, and increased social support also contributes to better HRQoL.

Longitudinal mediation analysis for HRQoL

The cross-lagged model in figure 3 demonstrated a good fit to the data, with χ^2/df=4.054, p<0.001; CFI=0.966; TLI=0.912; RMSEA=0.048, 95% CI (0.109, 0.189); SRMR=0.036, with standardised parameter estimates detailed in the graphical representation. On incorporating adjusting variables, such as gender and age, the model fit did not significantly differ from the original model. Specifically, at T1, there was a significant association between HRQoL and social support and both mental resilience. Additionally, a positive correlation was observed between social support and mental resilience, with both variables being strongly linked to HRQoL. The autoregressive effects were statistically significant with values ranging from 0.024 (mental resilience T2, HRQoL T3) to 1.007 (HRQoL), indicating that the variables exhibited moderate to high stability throughout the study duration.

After accounting for the stability of the variables, we discovered that mental resilience at T2 predicted HRQoL at T3. Longitudinal mediation analysis revealed mental resilience at T2 fully mediated the relationship between

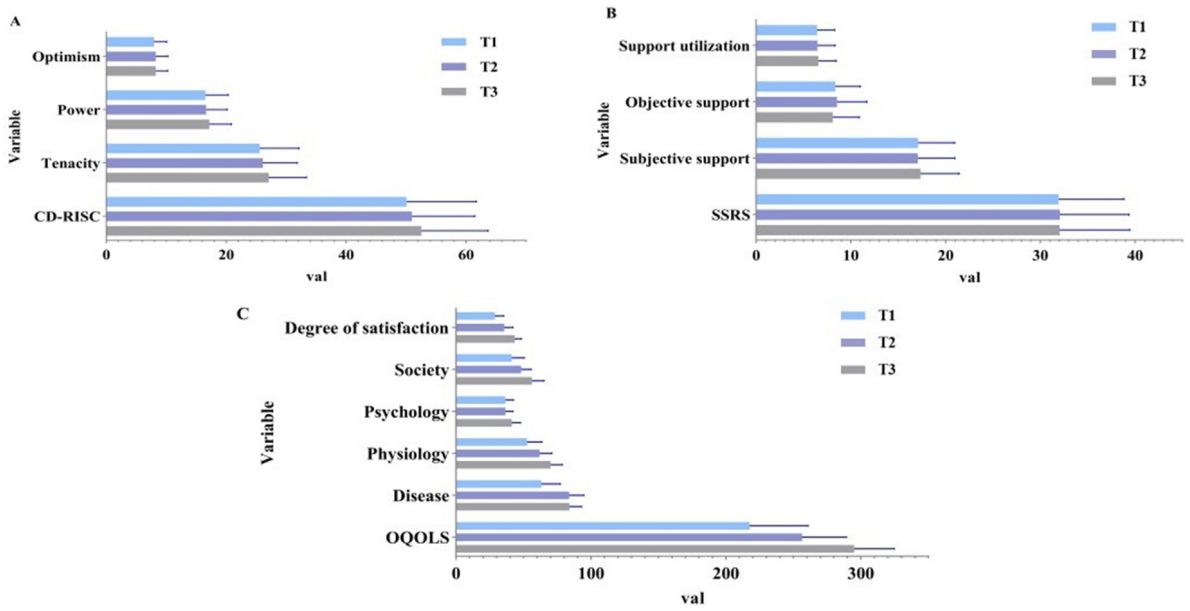

Figure 2 The mean scores for each scale for each time point analysed by repeated measures analysis of variance. T1: 1 day after surgery; T2: 1 month after surgery; T3: 3 months after surgery. (A) The mean score of Connor-Davidson Resilience Scale (CD-RISC) for each time points (F=11.154, p<0.001); (B) The mean score of the Social Support Rate Scale (SSRS) for each time point (F=1.120, p<0.001); (C) The mean score of the Osteoporosis Quality of Life Scale (OQOLS) for each time point (F=231.137, p<0.001).

baseline social support (T1) and subsequent HRQoL (T3), as documented in table 2. Consequently, individuals who have substantial social support are inclined to present mental resilience in their daily lives, ultimately contributing to improved HRQoL outcomes in postoperative OVCF patients (total effect: β=10.07, SE: 0.489; p=0.039).

Secondary outcomes

Multiple linear regression for HRQoL

The multiple regression analysis identified independent predictors of HRQoL in postoperative OVCF patients, as detailed in table 3. At baseline (T1), the regression equation of HRQoL showed R^2=0.257 (F=21.447, p<0.001). Male (β=−0.153, p<0.001), advanced age (β=−0.221, p<0.001), high mental resilience (β=0.412, p<0.001), high subjective support (β=0.413, p<0.001), high support utilisation (β=0.197, p=0.002), strong power (β=0.193, p=0.022), high optimism (β=0.141, p=0.006) and high monthly income (β=0.081, p=0.024) were predictive of higher HRQoL. In view of T2, the regression equation of HRQoL demonstrated R^2=0.269 (F=31.553, p<0.001). Male (β=−0.199, p<0.001), advanced age (β=−0.115, p=0.002), the high subjective support (β=0.287, p<0.001) and strong power (β=0.344, p<0.001) enhanced HRQoL.

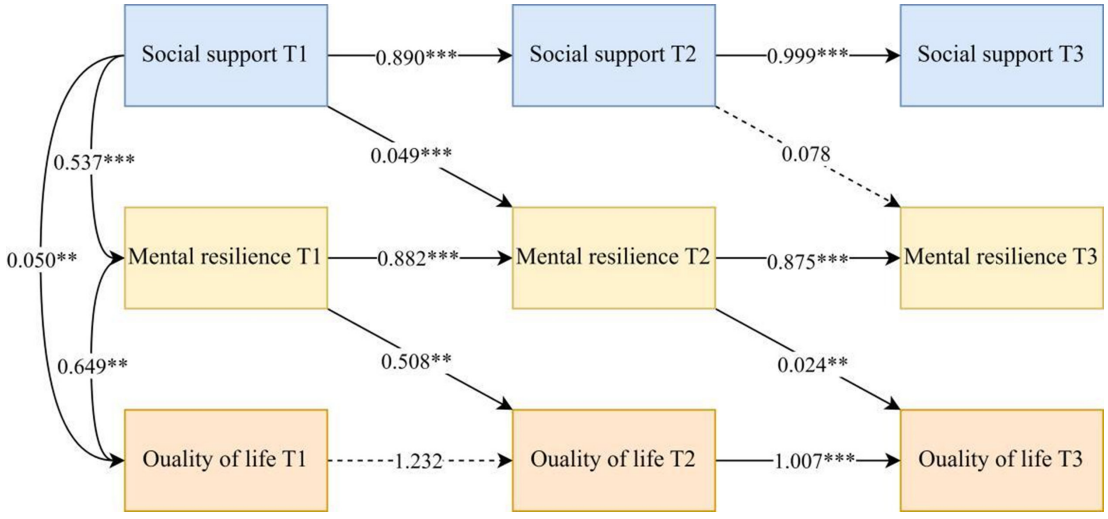

Figure 3 Cross-lagged model with mental resilience, social support and health-related quality of life among patients after surgery for osteoporotic vertebral compression fractures at three time points (**p<0.01; ***p<0.001). For the sake of clarity, non-significant paths are omitted from the figure.

Table 2 Results of the mediation effect analysis

Model pathways	Standardised effect (β)	SE	95% CI	P value
Direct effect Social support T1→ HRQoL T3	0.381	0.550	−0.698 to 1.459	0.049*
Indirect effect Social support T1→ Mental resilience T2 → HRQoL T3	0.636	0.047	0.016 to 0.205	<0.001**
Total effect Social support T1→ HRQoL T3	1.017	0.489	0.058 to 1.975	0.039*

*p<0.05, **p<0.001.
HRQOL, health-related quality of life.

Table 3 Multiple regression analysis predicting health-related quality of life

Predictors	β	T	P value
T1			
Gender	−0.153	−4.287	<0.001***
Age group	−0.221	−5.375	<0.001***
Mental resilience	0.412	3.417	0.001**
Subjective support	0.413	4.484	<0.001***
Support utilisation	0.197	3.138	0.002**
Power	0.153	2.302	0.022*
Optimism	0.141	2.743	0.006*
Monthly income	0.081	2.260	0.024*
R^2=0.257, R^2 adjusted=0.245, F=21.447, p<0.0001			
T2			
Gender	−0.199	−5.809	<0.001***
Age group	−0.115	−3.097	0.002**
Power	0.344	5.311	<0.001***
Subjective support	0.287	7.007	<0.001***
R^2=0.269, R^2 adjusted=0.260, F=31.553, p<0.0001			
T3			
Gender	−0.154	−4.297	<0.001***
History of smoking	−0.137	−3.756	<0.001**
Diabetes	0.126	4.266	0.001**
Power	0.269	4.700	<0.001***
Social support	0.808	12.972	<0.001***
Subjective support	1.004	15.853	<0.001***
R^2=0.428, R^2 adjusted=0.417, F=38.407, p<0.001			

Assignment situation of the independent variables.
Males=1 females=2; age group 50–60=1 60–70=2 70–80=3 80 plus=4.
Monthly income<2000/monthly=1 2000–3999/monthly=2 4000–5999/monthly=3 6000–7999/monthly=4.
History of smoking: smoke=1, no smoking=2.
Diabetes: yes=1, no=2.
Mental resilience, subjective support, support utilisation, power, optimism, Ssocial support=as the raw data entry.
*p<0.05, **p<0.01, ***p<0.001.

The regression equation of HRQoL for T3 showed R^2=0.428 (F=38.407, p<0.001). Male (β=−0.154, p<0.001), smoking (β=−0.137, p<0.001), diabetes (β=0.126, p<0.001), high social support (β=0.808, p<0.001), high subjective support (β=1.004, p<0.001) and strong power (β=0.269, p<0.001) were predictive of increased HRQoL.

DISCUSSION

The aim of this study is to examine dynamic changes in HRQoL of postoperative OVCF patients and those influential factors, with a focus on the potential mediation of mental resilience. To the best of our knowledge, this study represents the first to emphasise the crucial role of mental resilience as a mediator between social support and HRQoL in the context of surgical treatment for OVCFs through a longitudinal study.

Our analysis revealed that patients with OVCFs demonstrate reduced functional capacity across all assessment scales during the early postoperative phase, accompanied by measurable psychological distress. This mental strain appears multifactorial, originating from body image alterations, persistent pain syndromes and impaired social participation.[24] Individuals exhibiting elevated mental resilience scores displayed enhanced adaptive capacities to navigate disease-related challenges, including treatment complications and long-term therapeutic regimens.[25] One innovative solution is resilience training including stress management and resilience training, which could potentially enhance mental health for individuals undergoing preventive cardiology interventions,[26] educators and staff in public schools,[27] and recent nursing graduates.[28] The mechanistic parallels suggest potential applicability for postoperative OVCF populations to strengthen coping strategies and psychological adaptation. Social support served as a crucial protective factor for postoperative HRQoL among patients with OVCFs, particularly in alleviating stress and enhancing emotional well-being derived from family members.[29] As one of the support systems, social support provided by healthcare providers can also significantly enhance patients' HRQoL.[30] The crucial role of spouses' emotional assistance has been acknowledged from initial diagnosis to

subsequent treatment postsurgery.[31] These may in turn have contributed to higher assessments of HRQoL.

It is conceivable that such an ascending trend is more pronounced when assessing general features of HRQoL of OVCF patients in the early stage following surgery. The multiple linear regression analysis of T3 shows that individuals having smoking behaviours experience relatively lower HRQoL. Compelling evidence indicates that there is a correlation between smoking and reduced bone density, that is, smokers experience bone loss at a rate 1.5–2 times faster than non-smokers.[32] The resultant osteoporosis exacerbation manifests clinically as progressive vertebral deformity, chronic pain amplification and consequent HRQoL degradation.[33] In our study, postoperative male patients exhibited better HRQoL than females, which is consistent with previous studies.[11 34] The proportion of female patients is twice that of male ones. Previous studies indicate that females present greater susceptibility to osteoporosis and fragility fractures in comparison to male counterparts.[35] Among individuals aged 50 and above, the incidence of fractures in females is approximately twice that in males; this is also consistent with our results. This discrepancy may partially stem from males' enhanced stress-coping mechanisms during rehabilitation.[36] Patients with chronic diseases, such as diabetes, usually experience the decline in their physical and immune functions as age advances. Especially, OVCF patients in conjunction with diabetes are confronted not only with the debilitating pain of these fractures, which significantly impairs daily activities and reduces their HRQoL, but also facing the challenges of diabetes-related complications, such as renal and ocular diseases. Precautions against the potential complications related to the fractures are urgently needed, including infections and thrombosis. These intersecting factors create a self-reinforcing cycle of physical disability and psychological vulnerability, substantially compromising both mental resilience and HRQoL.[37] Besides, there is also an increased risk of postoperative complications that slow patients' recovery and lower their life quality.[38] Postoperative teams could emphasise early engagement in functional exercises to mitigate adverse outcomes.[39]

Mental resilience is a positive feature that affects HRQoL, and research suggests that people who have a high level of mental resilience have a greater HRQoL.[40] Our study indicates that the mental resilience of patients after surgery exhibits a potential complete mediating effect between social support and HRQoL. However, it is noteworthy that mediation analysis may sometimes tend to present complete mediation when the sample size or total effect are small. When conducting mediation analysis, all mediation effects should be regarded as partial mediation rather than complete mediation.[41] When considering mental resilience as the sole mediator between social support and HRQoL, it precludes the examination of other potential mediating variables. Consequently, mental resilience serves as a strong mediating factor between social support and HRQoL. More importantly, longitudinal studies constitute an optimal approach for evaluating HRQoL and identifying influential factors. One study reports that mental resilience mediates the correlation between social support and HRQoL among Chinese cervical spondylosis patients.[42] Mental resilience acts as a mediator between perceived social support and HRQoL in patients with cancer.[43]

Social support not only directly affects HRQoL of postoperative OVCF patients but also indirectly influences it through mental resilience. Social support possesses the potential to mitigate the adverse effects of stressors. For example, encouraging patients' optimistic attitude towards the course of their diseases may help them better cope with being ill and more quickly resume high-quality life.[44] Individuals with robust social support networks in the form of material or emotional assistance often exhibit greater resilience, resulting in greater self-cognition when facing challenges.[45] As mental resilience changes through the course of disease, social support represents an external resilience factor that may facilitate adaptation and improve postoperative HRQoL.[46 47] Integrating a brief form of HRQoL monitoring into clinical routine could be an excellent strategy for detecting physical and mental problems when tracking the course over time.

In this study, some limitations should be considered. Participants were recruited through convenience sampling from a single medical institution in Southern China, potentially introducing selection bias. The relatively small sample size may diminish the statistical power and restrict the generalisability to other regions. Also, the study was unable to have sound conclusions when concerning the comparison of subgroups. Individuals with higher socioeconomic status might contribute to the good HRQoL assessments and possibly being overestimated. Besides, the exclusive focus on early postoperative outcomes (0–3 months) fails to capture longitudinal HRQoL trajectories and potential late-stage complications. Future investigations should implement protocols with follow-up ≥12 months to delineate recovery patterns and chronic health impacts.

Taken together, the study did reveal some detriments for OVCF patients in specific dimensions, and the HRQoL gradually improved in the early postoperative stage after surgery as time advanced. Mental resilience, social support and HRQoL are all interrelated, and mental resilience serves as a longitudinal mediator between social support and HRQoL. Future multicentre studies with larger sample sizes are anticipated to examine the effect of mental resilience and social support on the HRQoL of OVCF patients early after surgery.

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