

Possible Association between Rotator Cuff Repair and Suicide: A Nationwide Cohort Study Using Propensity Score Matching

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Background: Following rotator cuff repair surgery (RCR), patients can face considerable psychological distress due to factors such as ongoing intense pain, difficulties in the rehabilitation process, remnant functional limitations, and the potential risk of complications such as retear. The incidence and risk of suicide in these patients are poorly understood. Therefore, we aimed to investigate the incidence rate (IR) of suicide-related death over time and analyze the association between RCR and suicide using a representative nationwide large cohort database.

Methods: We selected RCR patients from the National Health Insurance Service (NHIS) Sample cohort (2007–2018) and a control group without rotator cuff tear. A time-dependent 1:1 propensity score matching (standardized differences < 0.1) was performed. Suicide cumulative incidence was analyzed using Kaplan-Meier curves and the stratified log-rank test. The suicide IR and 95% CI were calculated with a generalized linear model (Poisson distribution). The effect size was presented as a hazard ratio (HR) using Cox's proportional hazards model with robust variance to account for clustering within matched pairs.

Results: We included 3,992 incident RCR patients and 3,992 matched controls. The IR of suicide among RCR patients was 62.61 per 100,000 person-years for a period of more than 1 year and 56.15 per 100,000 person-years (95% CI, 32.61–96.68) during the entire follow-up period. During the entire follow-up and a period of more than 1 year after RCR, RCR patients were 3.19 times and 5.86 time more likely to die by suicide than their matched controls (95% CI, 1.04–9.76; $p = 0.043$ and 95% CI, 1.31–26.15; $p = 0.021$, respectively).

Conclusions: Patients who underwent RCR demonstrated no association with suicide within the first postoperative year, but a noticeable trend of increased suicide incidence emerged after this period. This finding suggests the potential impact of challenges, such as intense pain, rehabilitation difficulties, persistent functional limitations, and RC retear, on the psychological well-being of patients following RCR. It is imperative that these patients receive close monitoring and appropriate interventions for timely and appropriate psychiatric care.

Keywords: Rotator cuff tear, Rotator cuff repair, Suicide, Nationwide cohort study

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Rotator cuff repair (RCR) is one of the most common orthopedic surgeries performed and represents the standard of care for symptomatic rotator cuff tears (RCTs) that have failed conservation.¹⁾ Various surgical approaches can be used based on factors such as RCT size, tendon quality, remaining muscle volume, and degree of fatty infiltration. Positive outcomes are generally reported in terms of

improving patients' pain and functional limitations, both of which can impact their daily activities and quality of life.²⁾ Nevertheless, as the elderly population increases, an increasing number of patients are undergoing RCR, and unsatisfactory clinical results have been reported, although they remain at a low percentage.³⁾ Approximately 4%–5% of patients who undergo RCR may require revision surgery due to retear, and 41% of these individuals may exhibit poor clinical outcomes.⁴⁾ Patients with diabetes or those who experience postoperative infections also tend to have a worse prognosis.⁵⁾ In addition to the physical burden, RCR patients often experience significant psychological challenges. Chronic shoulder pain, functional disability, and persistent symptoms after surgery can lead to heightened psychological stress. In these patients, shoulder pain and function can be influenced by a complex interplay of factors, including lesion size, surgical success, occupational and social factors, and psychological elements.⁶⁾ Furthermore, given that patients with RCT exhibit a psychological vulnerability to stressful situations, as evidenced by the observation of depression and other psychiatric comorbidities such as sleep disorders in up to 28% of cases, we believe that the risk of severe psychological distress may be influenced by the postoperative course.^{7,8)} These psychological factors may act as precursors to more severe outcomes, such as suicidal ideation or suicide, particularly in cases of unsatisfactory surgical outcomes.

Suicide is a major public health issue worldwide, accounting for 750,000 deaths in 2019.⁹⁾ Previous studies have reported risk factors for suicide to include low income, alcohol abuse, mental disorder, chronic pain, medical conditions, functional disability, and opioid use.¹⁰⁾ Patients who undergo RCR require essential pain management because of the occurrence of severe pain after surgery, which can impact their rehabilitation therapy.¹¹⁾ Lack of proper pain control naturally affects clinical outcomes. However, it has been reported that preoperative opioid use in these patients is remarkably high, reaching up to 43%, which carries a risk of chronic use.¹²⁾ Furthermore, residual symptoms or unsatisfactory outcomes following RCR may influence a patient's mental health status. While the prevalence of RCTs is higher among older individuals, modern societal trends, combined with an increasing number of seniors wishing to remain physically active, have resulted in more frequent RCRs being performed on socioeconomically active individuals.¹³⁾ Therefore, although post-RCR suicide may be a rare occurrence, it carries substantial socioeconomic implications when it does occur. Given the seriousness of this concern, post-RCR suicide merits further attention and the development

of preventive strategies. However, no previous study has reported the associations between RCR and psychological issues such as suicide.

Therefore, we aimed to investigate the incidence rate (IR) of suicide-related death over time, and analyze the association between patients after RCR and suicide using a representative nationwide large cohort database. We hypothesized that the incidence of suicide events may increase in patients who have undergone RCR, especially among those with persistent symptoms or poor postoperative recovery.

METHODS

The Institutional Review Board of Daejeon Eulji Medical Center approved the study design and protocol (IRB No. EMC 2022-11-017). As this was a retrospective study, the requirement for written informed consent was waived for all patients involved.

Patients who had undergone RCR and matched subjects (matched controls) were selected from the National Health Insurance Service (NHIS) Sample cohort version 2.2 of South Korea. The NHIS established the National Health Information Database (NHID), a claims database for research purposes, which stores all records of healthcare and long-term care services.¹⁴⁾ From the NHID, the NHIS constructed and provided researchers with the NHIS-Sample, a representative administrative dataset for health policy and biomedical research purposes. The NHIS has published a detailed cohort profile. The NHIS-Sample consists of a million people selected using a systematic stratified random sampling method from 48,222,537 subjects on December 31, 2006. Under the compulsory social insurance system of the National Health Insurance Act, all subjects could be followed until 2018, except for instances of death or emigration. Therefore, the data from 2007 to 2018 are representative data for the Korean population, whereas the data from 2002 to 2006 correspond to the past data of the selected patients. The NHIS maintains all personal information, demographics, and medical treatment data for the entire Korean population. The key variables in the NHIS-Sample cohort include all inpatient and outpatient medical claims data, such as codes for treatment procedures, prescriptions, and diagnoses.

RCR Cohort

The inclusion criteria for the RCR cohort included the following diagnostic codes, as defined by the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10): M751 (rotator cuff

syndrome, rotator cuff rupture), S4600, and S4608 (rotator cuff injury). Patients were defined as individuals > 40 years of age who were first admitted to an acute care hospital and underwent RCR during the period 2002–2018. Among the patients who met the inclusion criteria, the following patients were excluded to maintain the validity of the study design: patients who underwent RCR before January 1, 2007 (to ensure a minimum 5-year RCR-free period) and patients under the Medical Aid program (owing to the possibility of incomplete information). The incidence date (time-zero) of RCR was defined as the date of admission to the acute care hospital that fulfilled the inclusion criteria.

Identification of Suicide Cases

South Korean law requires that all death certificates are reported to Statistics Korea. Information on deaths (date and cause) was collected from this agency and individually linked to the patients included in our study using unique personal identification numbers. Death by suicide was identified as the cause of death and categorized under “Intentional Self-Harm” (ICD-10 codes X60 to X84). The time of the event was defined as the date of death by suicide.

Risk-Set Matching on Propensity Score

Risk-set matching was performed after calculating the time-dependent propensity score. To adjust for confounding effects, the association between RCR and suicide risk was examined using a time-dependent propensity score matching. Hazard ratio (HR) adjusted by propensity scores were estimated using Cox’s proportional-hazards regression model, with January 1, 2007 as the baseline and RCR as the event. All variables shown in Table 1 were included as independent variables, all of which were identified in the 5 years prior to baseline (January 1, 2007). Age and the square of age were included as continuous variables. Categorical variables included sex, household income level, type of National Health Insurance, registered disability, residential district as a fixed effect, Charlson Comorbidity Index (CCI), number of hospital admissions, medication history, and medical history. The number of comorbidities for each participant was assessed by diagnostic codes using the Quan et al. ICD-10 coding algorithm for the CCI score. Patients who had a record (> 90 days) of antihypertensive, antidiabetic, lipid-lowering, and/or antidepressant drug prescriptions were taking the corresponding medications.

Based on time zero, RCR patients were matched for age and sex to subjects who were at risk of developing

an RCT. After constructing the first risk set, this method of risk set matching was repeated sequentially until most RCR patients were matched. Subsequently, 1 : 1 matching based on the propensity score was sequentially performed for each risk-set using a nearest neighbor matching algorithm to estimate the HR. To ensure that the matching was independent of future events (RCR), the matched control subjects could be either those who never developed RCR or were yet to undergo RCR. Therefore, patients in the RCR cohort could also act as matched controls for other RCR patients whose incident date was prior to that of the control patients.¹⁵⁾ Although the NHIS sample was constructed retrospectively, our study design emulated a prospective randomized controlled trial. Next, to yield non-overlapping samples from the risk set, the matched subjects were removed from the next risk sets. The matching process was repeated with the next risk set and terminated when there were no more RCR patients.

Statistical Analyses

Statistical tests for the association between RCR and suicide risk were performed after considering the nature of the matched pair analyses. To assess the covariate balance between treatment groups, baseline characteristics were compared by standardized differences, where a difference of < 0.1 (10%) was generally considered negligible. Several time frames (before 365 days, after 365 days, and whole follow-up days) were used as follow-up periods for survival analyses. Cumulative incidence curves for suicide were obtained using the Kaplan-Meier method, and comparison of the curves was conducted using the stratified log-rank test. The cumulative incidence of suicide and 95% CIs were estimated using the product limit (Kaplan-Meier) estimator method for survival probability. The IR and 95% CI of suicide were calculated based on a generalized linear model with a Poisson distribution and robust standard error. The IR was expressed as the number of suicides per 100,000 person-years. The effect size was presented as an HR using Cox’s proportional hazard model with a robust variance estimator that accounted for clustering within matched pairs. The incident date was set as the date of RCR for both the RCR cohort and matched controls. Survival time was defined as the number of days from the incidence date to the date of death or December 31, 2018, whichever occurred first. In addition to the above cause-specific models, a competing risk model was used for sensitivity analysis in which death not caused by suicide was considered a competing risk. Statistical analyses were conducted using SAS Enterprise Guide version 7.1 (SAS Institute). Means are presented with standard deviations.

Table 1. Baseline Characteristics of the Sample

Characteristics	RCR patients (n = 3,992)	Matched controls (n = 3,992)	Standardized difference
Age (yr), mean $\pm$ SD	55.89 $\pm$ 7.80	55.89 $\pm$ 7.80	0
Female	2,049 (51.3)	2,049 (51.3)	0
Household income level (decile)			0.015
First	306 (7.7)	304 (7.6)	
Second	235 (5.9)	243 (6.1)	
Third	227 (5.7)	226 (5.7)	
Fourth	314 (7.9)	308 (7.7)	
Fifth	345 (8.6)	346 (8.7)	
Sixth	360 (9.0)	361 (9.0)	
Seventh	454 (11.4)	464 (11.6)	
Eighth	513 (12.9)	519 (13.0)	
Ninth	576 (14.4)	569 (14.3)	
Tenth	662 (16.6)	652 (16.3)	
Type of national health insurance			0.018
Self-employed	1,091 (27.3)	1,119 (28.0)	
Dependents of self-employed	586 (14.7)	590 (14.8)	
Employee	856 (21.4)	850 (21.3)	
Dependents of employee	1,459 (36.5)	1,433 (35.9)	
Registered disability	304 (7.6)	282 (7.1)	0.021
Residential district			0.021
Seoul	741 (18.6)	775 (19.4)	
Busan	299 (7.5)	283 (7.1)	
Daegu	165 (4.1)	140 (3.5)	
Incheon	208 (5.2)	210 (5.3)	
Gwangju	150 (3.8)	158 (4.0)	
Daejeon	99 (2.5)	95 (2.4)	
Gyeonggi-do	784 (19.6)	788 (19.7)	
Gangwon-do	103 (2.6)	81 (2.0)	
Chungcheongbuk-do	118 (3.0)	123 (3.1)	
Chungcheongnam-do	161 (4.0)	161 (4.0)	
Jeollabuk-do	215 (5.4)	226 (5.7)	
Jeollanam-do	277 (6.9)	289 (7.2)	
Gyeongsangbuk-do	269 (6.7)	277 (6.9)	
Gyeongsangnam-do	366 (9.2)	359 (9.0)	
Jeju-do	37 (0.9)	27 (0.7)	

Table 1. Continued

Characteristics	RCR patients (n = 3,992)	Matched controls (n = 3,992)	Standardized difference
Charlson Comorbidity Index score		0.041	-
0	2,157 (54.0)	2,230 (55.9)	
1	1,116 (28.0)	1,067 (26.7)	
2	459 (11.5)	438 (11.0)	
3	172 (4.3)	163 (4.1)	
4	48 (1.2)	50 (1.3)	
≥ 5	40 (1.0)	44 (1.1)	
Number of hospital admission			0.015
0	2,824 (70.7)	2,856 (71.5)	
1	760 (19.0)	746 (18.7)	
≥ 2	408 (10.2)	390 (9.8)	
Past medication history			
Anti-hypertensive agents	954 (23.9)	921 (23.1)	0.020
Anti-diabetic agents	286 (7.2)	254 (6.4)	0.032
Lipid lowering agents	429 (10.7)	396 (9.9)	0.027
Antidepressive agents	172 (4.3)	135 (3.4)	0.048
Benzodiazepines	547 (13.7)	500 (12.5)	0.035
Prescription days of opioids			0.027
0	636 (15.9)	635 (15.9)	
1 ≤ day ≤ 3	587 (14.7)	595 (14.9)	
4 ≤ day ≤ 8	723 (18.1)	684 (17.1)	
9 ≤ day ≤ 17	797 (20.0)	815 (20.4)	
18 ≤ day	1,249 (31.3)	1,263 (31.6)	
Past medical history			
Malignant neoplasm	73 (1.8)		-0.020
Ischemic heart disease	240 (6.0)		0.045
Stroke	83 (2.1)		0.024

Values are presented as number (%). At the time of rotator cuff repair in each patient, two controls were matched on propensity score estimated by the Cox proportional hazard model with predictors included in this table.
 RCR: rotator cuff repair, SD: standard deviation.

p-values < 0.05 were considered statistically significant.

RESULTS

From January 1, 2002, to December 31, 2018, 5,332 individuals met the inclusion criteria. Among these partici-

pants, 254 patients aged < 40 years, 867 patients with an RCR during the first 5 years, and 173 enrollees of the Medical Aid program were excluded. During risk-set matching, 102 patients with RCR were not matched to control subjects, and 46 RCR patients entered the study as control subjects for another RCR patient. Therefore, 3,992 RCR

patients and their 3,992 matched controls were included in the final analysis.

The mean follow-up time was 5.75 ± 2.02 years, which signified 45,927.7 person-years. During the follow-up, 17 suicide deaths were identified (4 deaths in the matched cohort and 13 deaths in the RCR patient cohort). Table 1 shows the baseline characteristics of the matched cohorts. The mean age was 55.89 ± 7.80 years, and 51.3% of the patients were female. During the first 365 days of the follow-up period, 1 suicide was identified in the RCR patients during 3,984.3 person-years (IR, 25.1 per 100,000 person-years; 95% CI, 3.53–177.72). The difference in the risk of suicide between RCR patients and matched controls within the first 365 days following RCR was not significant (HR, 0.50; 95% CI, 0.05–5.51; $p = 0.570$) (Table 2). From 365 days to the last follow-up, 12 suicides were identified for 19156.7 person-years (IR, 62.61 per 100,000 person-years; 95% CI, 35.56–110.22) among the RCR patients. The RCR patients were 5.86 times more likely to die by suicide than their matched controls during this later period (95% CI, 1.31–26.15; $p = 0.021$) (Table 2). During the entire follow-up period, the IR of suicide in RCR patients was 56.15 per 100,000 person-years (95% CI, 32.61–96.68). The RCR patients were 3.19 times more likely to die by suicide than their matched controls during the entire follow-up period (95% CI, 1.04–9.76) ($p = 0.043$). The results from the competing risk model were similar to those from the cause-specific models.

DISCUSSION

In the present study, which used a large nationwide cohort, it was observed that patients undergoing RCR did not exhibit an immediate association with suicide within the first postoperative year. However, the data revealed a concerning trend in that the suicide IR among RCR patients stood at 56.15 per 100,000 person-years throughout the entire follow-up duration, with a marked increase observed after the initial postoperative year.

We found a relatively high rate of suicide in patients who had undergone RCR compared to the control group. A study of suicide rates due to physical disease in elderly patients in Denmark found rates of 43.7 per 100,000 person-years for men and 18.7 per 100,000 person-years for women.¹⁶⁾ The suicide rate among patients with lung cancer in the United States was 27.5 per 100,000 person-years,¹⁷⁾ and Yousaf et al.¹⁸⁾ reported that the age-standardized suicide rate in a Danish study of 564,517 patients with cancer was 6.1–30.2 per 100,000 person-years. Compared to patients with other pathologies, the IR of suicide in RCR patients, which was 56.15 per 100,000 person-years during the entire follow-up period, was relatively high. Fortunately, the rate of suicide in RCR patients in the present study was lower than that of spinal fractures (156 per 100,000 person-years)¹⁹⁾ or hip fractures (266.1 per 100,000 person-years) in the elderly.²⁰⁾ However, compared to other orthopedic procedures such as total knee arthroplasty or total hip arthroplasty, which report suicide rates of approximately 10–20 per 100,000 person-years, the rate in RCR patients appears substantially higher.^{21,22)} This sug-

Table 2. Incidence Rates of Suicide in the RCR Cohort and Matched Controls Showing the Association between RCR and the Risk of Suicide

Exposure	Number of subjects	Number of suicides (%)	Person-years	Incidence rate per 100,000 person-years (95% CI)	Hazard ratio (95% CI)	<i>p</i> -value
Whole follow-up period						
Matched control	3,992	4	22,786.8	17.55 (6.58–46.75)	1	
RCR patients	3,992	13	23,141.0	56.15 (32.61–96.68)	3.19 (1.04–9.76)	0.043
0–1 yr						
Matched control	3,992	2	3,972.2	50.21 (12.56–200.70)	1	
RCR patients	3,992	1	3,984.35	25.03 (3.52–177.72)	0.50 (0.05–5.51)	0.498
> 1 yr						
Matched control	3,992	2	18,814.5	10.62 (2.66–42.48)	1	
RCR patients	3,992	12	19,156.7	62.61 (35.56–110.22)	5.86 (1.31–26.15)	0.021

RCR: rotator cuff repair.

gests that the unique physical and psychological demands associated with RCR recovery may contribute to this elevated risk.^{23,24)}

Furthermore, in this study, we found an increased suicide IR after postoperative 1 year of RCR. The absence of a heightened risk of suicide in the immediate year after surgery indicates that the procedure itself is unlikely to be the direct cause. Alternatively, underlying psychiatric conditions such as undiagnosed depression or socioeconomic stressors including financial burdens associated with prolonged rehabilitation could have influenced the observed trends. Future studies should incorporate these variables to better disentangle the direct effects of RCR from broader contextual factors. Notwithstanding a few reports on the possibility of several psychological comorbidities in patients with RCTs, their relationship with suicide has not been reported previously.^{21,22)} Many patients with RCTs have comorbidities related to psychological disorders, such as sleep disorders, depression, and anxiety disorders, which have been reported in up to 89%, 26.2%, and 23.4% of patients, respectively. This patient group appears to exhibit a high vulnerability to psychological stress. The prevalence of this condition is higher than that reported in patients undergoing total joint arthroplasty (depression, 22.5%–25%; anxiety, 11.5%–20.2%).^{23,24)} For patients with RCTs, undergoing RCR could lead to improvements in psychological well-being and health-related quality of life, and may have the added benefit of reducing sleep disturbances.^{21,22)} However, patients who experience poor clinical outcomes continue to complain of sleep disorders or psychological problems.²³⁾

In other aspects, while RCR typically has a high success rate with a significant portion of patients reporting satisfaction, some patients may continue to experience chronic pain after surgery. It is within this subset of patients where a potential explanation for an increased risk of suicide could emerge, although more research is needed to definitively establish this connection. Chronic pain, identified as a risk factor for suicide in numerous studies,^{25,26)} and ongoing discomfort or functional limitations after RCR could exacerbate underlying mental health issues. Pain management strategies, including the appropriate use of multimodal analgesia and early intervention for patients at risk of chronic pain, are critical in mitigating this risk. The failure of such strategies, particularly in patients with persistent pain despite surgery, can lead to a sense of hopelessness and increased vulnerability to suicidal ideation. Addressing these gaps in pain management should be a priority in postoperative care. A longer duration of pain may further complicate psychosocial adjust-

ment, highlighting the complex interplay of physical and mental health factors.²⁷⁾

In addition, severe pain during the postoperative acute period and the rehabilitation process can cause considerable stress, sometimes leading to chronic pain.¹¹⁾ It has been reported that chronic use of opioids to control this pain can result in RCR.¹²⁾ Moreover, functional limitations or retear of an RCT can increase dependence on others when performing activities of daily living.⁴⁾ Patients who undergo revision surgery or those who have experienced surgical site infections are also more prone to poor clinical outcomes.⁵⁾ It has also been reported that patients with decreased frequency of postoperative follow-ups experience an increased sense of isolation and elevated stress levels.²⁸⁾ The frequency of patients who continue to experience discomfort or for whom the surgery did not meet their initial expectations is higher among those with lower-frequency follow-up.²⁸⁾ Taking these factors into consideration, we believe that our study can explain the increased risk of death by suicide following RCR, highlighting its prominence 1 year after surgery. However, despite the presence of suicide-related risk factors observed in these patients, further research is required to investigate the direct causes associated with suicide deaths.

The strengths of this study include the use of a large nationwide cohort, which enhances the generalizability of the findings. We also used propensity score matching to adjust for confounding effects, which strengthens the validity of the results. However, there are also some limitations that warrant discussion. First, the inclusion criteria for RCR patients were not representative of all RCTs that may have occurred. The inclusion criteria were defined based on first-time hospital admission for RCR, thereby excluding patients with asymptomatic RCTs or those with mild RCTs who opted for conservative treatment. Consequently, the suicide risk reported in this study reflects a specific subset of patients with symptomatic RCTs who required surgical intervention. This exclusion introduces the potential for selection bias, as it limits the analysis to individuals with greater symptom severity and the need for surgery. While this limitation reduces the generalizability of our findings to the broader RCT patient population, it enables a more focused examination of suicide risk among patients undergoing surgical treatment for severe RCTs. Secondly, we reinforced the contents for the support systems, pain management, and cultural social characteristics in Korea as follows: our study analyzed data from Korea's national claims database, and as such, the results may have been influenced by the country's socio-cultural characteristics, the nature of medical services provided within

the Korean healthcare system, and patients' healthcare utilization patterns. In Korea, there is significant social stigma surrounding mental illness, and many people hold negative perceptions toward psychiatric care.²⁹⁾ This atmosphere makes access to psychiatric care and support more difficult. Additionally, the negative perceptions surrounding the use of narcotic analgesics may complicate adequate pain management.³⁰⁾ However, surgical treatment methods and clinical outcomes for RCR appear to be similar across different races and regions, and the stressful situations induced by RCR are likely to be comparable. While there may be differences in IRs, the increased suicide risk following RCR and its timing are likely to be similar in other societies. Third, because suicide events are extremely rare in patients following RCR, their analysis is inherently difficult and may lead to underpowered results. Additionally, actual statistical significance might vary depending on factors such as the matching ratio, database, and analysis methods. However, national claims data represents a large dataset, and the sample cohort statistically reflects the entire population of South Korea. Therefore, it is well-suited for the analysis of very rare events. We believe that both our study design and statistical analysis have been reasonably well-constructed. However, further analysis will likely be needed using data from the entire population rather than just the sample cohort, or through other statistical settings, such as different matching ratios or analysis methods. Lastly, we were unable to analyze the underlying factors that caused RCR patients to commit suicide, such as depression or psychosis. The NHIS has masked sensitive diagnostic codes such as depression and psychosis due to concerns about sensitive medical conditions being combined with geographic information to allow identification of individual patients. However, we attempted to address these limitations by using medications such as antidepressants and benzodiazepines, as well as debilitating medical conditions such as neoplasm, ischemic heart disease, and

stroke. Nevertheless, further research is required to understand the underlying mechanisms and potential risk factors that contribute to this increased risk of suicide.

In conclusion, while this study observed a trend of increased suicide incidence among patients who underwent RCR after the first postoperative year, these findings should be interpreted with caution given the relatively small number of suicide cases. The data highlight the potential psychological vulnerabilities associated with chronic pain, rehabilitation challenges, and persistent functional limitations following surgery. However, the limited number of events underscores the need for further research to confirm these observations and explore underlying mechanisms.

Given the potential implications for patient care, it is essential for orthopedic surgeons to incorporate routine mental health screening into postoperative follow-ups, particularly for patients reporting persistent pain or dissatisfaction with surgical outcomes. Multidisciplinary care teams, including pain specialists and mental health professionals, can play a crucial role in providing tailored support. Developing clear protocols for identifying at-risk patients and ensuring access to appropriate interventions is necessary to translate these findings into clinical practice effectively.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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