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Prediction of Acute Postoperative Pain Severity Based on Emotional Schemas, Self-Compassion, and Pain Catastrophizing in Patients Undergoing Head and Neck Surgery

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A B S T R A C T

Acute postoperative pain is one of the major challenges of the postoperative period and, in addition to physiological factors, may also be influenced by patients' cognitive and emotional characteristics. The present study aimed to predict the severity of acute postoperative pain based on pain catastrophizing, self-compassion, and emotional schemas among patients undergoing head and neck surgery at Amir A'lam Hospital. The study employed a descriptive-correlational design with a predictive approach. The statistical population consisted of patients undergoing head and neck surgery who were referred to Amir A'lam Hospital in Tehran between March and August 2026, and data from 88 patients were included in the final analysis. The research instruments included the Pain Catastrophizing Scale developed by Sullivan, Bishop, and Pivik (1995), the Short Form of the Self-Compassion Scale developed by Raes et al. (2011), the Leahy Emotional Schema Scale, and the Visual Analog Scale (VAS) for pain. The psychological questionnaires were completed before surgery, and patients' pain intensity was measured on the first postoperative day using the VAS. Data were analyzed using Pearson's correlation coefficient, multiple linear regression analysis, and simple linear regression analyses. The results showed that the multiple regression model including pain catastrophizing, self-compassion, and emotional schemas was statistically significant overall, $F = 2.817$, $p = .044$, and explained 9.1% of the variance in acute postoperative pain severity. However, in the simultaneous model, the independent contribution of none of the three predictor variables reached statistical significance. In the simple regression analyses, pain catastrophizing and emotional schemas significantly predicted acute postoperative pain severity, whereas self-compassion was not a significant predictor. Accordingly, the findings indicate that certain cognitive-emotional components may be associated with the severity of acute postoperative pain; however, the explanatory contribution of these factors is limited, and the findings should be interpreted alongside the physical and clinical factors affecting postoperative pain.

Keywords: *acute postoperative pain, emotional schemas, self-compassion, pain catastrophizing, head and neck surgery.*

1. Introduction

Acute postoperative pain is one of the most common and clinically significant consequences of surgical intervention and remains a major concern despite considerable advances in anesthesia, multimodal analgesia, and perioperative care. Inadequately controlled postoperative pain can interfere with mobilization, sleep, respiratory function, nutritional intake, and participation in rehabilitation, while also contributing to prolonged hospitalization, greater opioid consumption, delayed recovery, and an increased risk of transition from acute to persistent postsurgical pain (1-3). Although tissue injury, inflammatory responses, surgical technique, type and duration of surgery, anesthesia, and analgesic protocols are central determinants of acute postoperative pain, pain experience is not simply a direct reflection of nociceptive input. Contemporary models conceptualize pain as a multidimensional biopsychosocial phenomenon shaped by interactions among biological processes, cognitive appraisals, emotional responses, behavioral tendencies, previous experiences, and contextual influences. Accordingly, patients undergoing apparently comparable surgical procedures may report markedly different levels of pain during the early postoperative period (4, 5). This variability is particularly important in head and neck surgery, where procedures may involve extensive tissue manipulation, functional structures related to speech and swallowing, airway-related concerns, oncological stress, and complex postoperative care. Research in head and neck surgical populations has shown that postoperative pain can remain substantial despite standard analgesic management and that both clinical and patient-related factors contribute to its intensity (6, 7). More recent evidence further suggests that psychological vulnerability before surgery may be associated with postoperative pain burden in patients undergoing major head and neck procedures, reinforcing the need to examine cognitive-emotional characteristics alongside conventional biomedical predictors (8).

The importance of identifying psychological predictors of postoperative pain stems from the fact that many such factors are potentially modifiable and may therefore provide targets for preoperative screening and intervention. Psychological states can alter attention to bodily sensations, appraisal of threat, expectations regarding pain, emotional arousal, coping behavior, and perceived control, all of which may influence pain perception and pain-related disability. Systematic evidence across surgical populations indicates that preoperative psychological variables are associated with postoperative clinical outcomes, including pain intensity, functional recovery, and perceived disability (5). Likewise, demographic and psychological factors have been found to contribute to early postoperative pain perception even in relatively localized surgical procedures, suggesting that the subjective pain response cannot be adequately understood through procedural characteristics alone (4). The growing emphasis on individualized postoperative pain management therefore requires attention to factors that influence how patients interpret and respond to nociceptive signals. Such an approach is compatible with current clinical guidelines advocating multidimensional pain assessment and individualized treatment planning rather than uniform analgesic strategies (3). Evidence from acute pain populations also supports the clinical relevance of psychological processes: interventions targeting cognitive and emotional responses have been associated with improvements in pain coping, psychological functioning, and pain-related outcomes (9, 10). These findings highlight the value of examining specific constructs that may shape postoperative pain, particularly pain catastrophizing, self-compassion, and emotional schemas.

Pain catastrophizing is among the most extensively investigated cognitive factors associated with pain. It refers to an exaggerated negative cognitive-affective orientation toward actual or anticipated pain and is commonly characterized by rumination, magnification, and feelings of helplessness. Individuals with high levels of catastrophizing tend to focus excessively on pain sensations, interpret them as threatening, anticipate severe consequences, and perceive themselves as having limited ability to manage the experience. Such processes can intensify attention to nociceptive signals, amplify emotional distress, increase physiological arousal, and reduce effective coping. In chronic pain conditions, pain catastrophizing has consistently been associated with greater pain intensity, functional limitations, psychological distress, and poorer quality of life (11, 12). Catastrophizing is also related to broader affective and metacognitive processes and may interact with anxiety sensitivity, emotional dysregulation,

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cognitive inflexibility, and avoidance-based coping (12, 13). Its significance is therefore not limited to the chronic pain context but extends to acute and perioperative pain, where anticipatory cognitions may influence the interpretation of postoperative sensations.

Evidence from surgical studies strongly supports the relevance of pain catastrophizing to postoperative pain. In patients undergoing abdominal surgery, higher catastrophizing has been associated with greater pain intensity and poorer postoperative mobility, suggesting that catastrophic cognitions may affect both symptom perception and functional recovery (14). Similarly, pain catastrophizing has been identified as an important mediator in the association between pain sensitivity and acute postoperative pain, indicating that cognitive interpretation may partly explain why individuals with greater pain sensitivity experience more severe postoperative pain (15). Prospective orthopedic studies have produced comparable findings. Higher preoperative catastrophizing has been associated with more intense pain during the first postoperative week following rotator cuff repair (16), while catastrophizing has also been linked to acute postoperative pain following unicompartmental knee arthroplasty (17). In total hip arthroplasty, pain catastrophizing has been associated with subjective pain and functional outcomes over longer follow-up periods, suggesting that its influence may persist beyond the immediate postoperative phase (18). Research outside the surgical setting also indicates that catastrophizing is related to cancer-related worry and perceived risk, underscoring its broader role in threat appraisal and symptom-focused cognition (19). Importantly, catastrophizing is responsive to psychological intervention. Compassion-focused acceptance and commitment therapy has been shown to reduce pain catastrophizing in individuals with multiple sclerosis (20), compassion-based therapy has reduced catastrophizing in older adults with depression (21), self-compassion training has influenced pain catastrophizing in pregnant women (22), and metacognitive therapy has also been used to target catastrophizing in women with lupus (13). These findings support the possibility that catastrophizing represents an important, clinically modifiable predictor of postoperative pain.

Self-compassion represents another psychological construct with potential relevance to pain regulation. Self-compassion involves responding to personal suffering with kindness rather than harsh self-judgment, recognizing distress as part of the common human experience rather than as an isolating event, and maintaining balanced mindful awareness rather than becoming overidentified with painful thoughts and emotions. In health contexts, self-compassion may reduce secondary emotional distress, promote adaptive self-regulation, facilitate acceptance, and weaken maladaptive cycles of threat appraisal and avoidance. A growing body of research has linked self-compassion to better psychological adjustment in individuals with chronic illness, with meta-analytic evidence demonstrating meaningful associations between greater self-compassion and lower psychological distress (23). Research specifically focused on chronic pain has also supported the relevance of self-compassion to pain-related outcomes and has provided psychometric support for its assessment in pain populations (24). From a physiological and behavioral perspective, self-compassion has been proposed as a resource that may reduce stress reactivity, improve emotion regulation, and strengthen adaptive coping with chronic illness and pain (25). It has also been associated with communication skills, self-worth, and social self-efficacy among women with chronic pain, suggesting that its benefits may extend beyond internal emotional regulation to broader psychosocial functioning (26).

Self-compassion may be especially relevant when pain is accompanied by fear, uncertainty, or a perceived loss of control. Individuals who respond to pain with self-criticism, isolation, and overidentification may experience greater emotional reactivity and may be more vulnerable to catastrophic interpretation of bodily sensations. By contrast, a self-compassionate stance may facilitate acceptance of temporary discomfort, reduce judgment toward one's emotional responses, and promote adaptive coping. Empirical studies support a close relationship between self-compassion and pain-related cognitive processes. Interventions centered on self-compassion have been associated with reductions in pain catastrophizing and improvements in distress tolerance (22). Compassion-based interventions have also improved pain-related cognitive and behavioral outcomes across different clinical populations (20, 21). In chronic low back pain, self-compassion has been incorporated into models linking emotional schemas, mood

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and anxiety symptoms, experiential avoidance, and pain outcomes, indicating that self-compassion may function not only as an independent resilience factor but also as part of a broader network of emotional and cognitive regulation processes (27). Findings in fibromyalgia similarly indicate that self-compassion coexists with constructs such as alexithymia and pain catastrophizing in shaping emotional functioning within chronic pain conditions (28). Research on other populations has likewise shown beneficial effects of self-compassion-oriented intervention on psychological control and impulsive responding under emotional distress (29). Although much of this literature has focused on chronic pain or broader psychological adjustment, the same regulatory mechanisms may plausibly influence acute postoperative pain, particularly during the first postoperative day when patients are exposed to unfamiliar pain, uncertainty, and reduced control.

Emotional schemas provide a complementary framework for understanding how individuals interpret and regulate emotional experiences. According to emotional schema theory, people develop beliefs and appraisals concerning the meaning, legitimacy, controllability, duration, comprehensibility, and acceptability of emotions, and these beliefs influence how emotions are processed and managed (30). Maladaptive emotional schemas may include beliefs that emotions are dangerous, uncontrollable, incomprehensible, invalid, shameful, or unacceptable, as well as tendencies toward rumination, blame, emotional suppression, excessive rationalization, and perceived lack of consensus with others. Such schemas can intensify emotional distress by transforming an initial emotional response into a secondary cycle of judgment, avoidance, rumination, or suppression. From this perspective, the experience of postoperative pain may be influenced not only by what patients think about pain itself but also by how they interpret and respond to the fear, frustration, vulnerability, uncertainty, and distress that accompany pain.

Research increasingly indicates that emotional schemas are associated with a range of psychological and pain-related outcomes. Emotional schemas have been linked to intolerance of uncertainty, with experiential avoidance acting as a mediating mechanism, suggesting that maladaptive beliefs about emotions may promote avoidance-based responses when individuals face ambiguous or distressing experiences (31). In chronic pain populations, emotional schemas have been incorporated into explanatory models of pain outcomes together with mood symptoms, anxiety, experiential avoidance, and self-compassion (27). Recent evidence from fibromyalgia also demonstrates that metacognitive and emotional schemas are associated with symptom severity, further supporting the relevance of higher-order beliefs about thoughts and emotions to pain-related experiences (32). These associations are clinically important because emotional responses to pain are not passive by-products of nociception; rather, they can shape attention, avoidance, coping, and perceived severity. Psychological treatments that modify emotional regulation, acceptance, or metacognitive processing have demonstrated benefits across chronic and acute pain-related conditions (9, 10, 33). In addition, emotional and interpersonal processes such as empathy, perceived social support, and mentalization have been implicated in the perception of chronic skeletal pain, illustrating the broader psychological context within which pain is experienced (34).

The potential interaction among pain catastrophizing, self-compassion, and emotional schemas is theoretically important. Pain catastrophizing represents a maladaptive interpretation of pain-related threat, emotional schemas concern beliefs about the legitimacy, controllability, and meaning of emotional experiences, and self-compassion represents an adaptive way of responding to suffering. These constructs may therefore reflect interconnected components of a larger cognitive-emotional regulatory system. For example, a patient who interprets pain catastrophically may experience greater fear and helplessness; if that individual simultaneously holds maladaptive emotional schemas, such as beliefs that distress is uncontrollable or unacceptable, emotional arousal may be further amplified. Conversely, a self-compassionate response may buffer these processes by reducing self-criticism, facilitating acceptance, and encouraging a more balanced relationship with unpleasant sensations and emotions. Evidence from chronic pain supports such interconnections among catastrophizing, emotional functioning, and self-compassion (27, 28). Furthermore, research showing that compassion-focused approaches can reduce catastrophizing suggests that these

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constructs are not independent psychological domains but may influence one another dynamically (20, 22).

Despite the growing body of research on psychological predictors of pain, several gaps remain. First, much of the existing literature concerns chronic pain disorders, musculoskeletal conditions, fibromyalgia, neurological diseases, or orthopedic procedures rather than acute pain after head and neck surgery (11, 24, 32). Second, although catastrophizing has received considerable attention in perioperative research, self-compassion and emotional schemas have been studied far less frequently as simultaneous predictors of acute postoperative pain. Third, the head and neck surgical context has distinctive clinical characteristics that may magnify psychological influences, including concerns about airway function, swallowing, communication, appearance, cancer diagnosis, and postoperative dependency. Earlier research has documented the difficulty of achieving adequate pain control after head and neck cancer surgery (6, 7), while more recent findings indicate that preoperative mental health risk factors are associated with postoperative pain in patients undergoing head and neck free flap reconstruction (8). At the same time, pharmacological and procedural approaches remain central to postoperative pain control, as demonstrated by studies examining analgesic regimens and local anesthetic strategies across surgical settings (35, 36). These biomedical approaches are indispensable, but they do not eliminate individual variability in pain experience, making psychological assessment an important complementary component of perioperative care.

The clinical importance of this issue is heightened by evidence that pain outcomes are influenced by both modifiable psychological processes and conventional medical management. Understanding the contribution of cognitive-emotional factors could support more precise preoperative risk stratification and help identify patients who may benefit from additional psychological preparation alongside standard analgesic treatment. Interventions targeting acceptance, pain self-efficacy, mindfulness, compassion, and maladaptive cognitions have already shown potential across diverse pain populations (10, 21, 33). Furthermore, psychological variables may have functional consequences beyond pain severity itself, affecting mobility, recovery behavior, coping, and broader adjustment (14, 18). Current evidence therefore supports a model in which postoperative pain emerges from the interaction of surgical, physiological, cognitive, and emotional determinants rather than from tissue injury alone. Studying pain catastrophizing, self-compassion, and emotional schemas together may clarify whether maladaptive threat appraisal, adaptive self-relating, and beliefs about emotional experience make distinct contributions to acute postoperative pain during the immediate recovery period.

Accordingly, the present study aimed to predict the severity of acute postoperative pain based on pain catastrophizing, self-compassion, and emotional schemas in patients undergoing head and neck surgery.

2. Methods and Materials

The present study was quantitative in nature and applied in terms of its purpose. It was a correlational study with a predictive approach. The statistical population consisted of all patients undergoing head and neck surgery who were referred to Amir A'lam Hospital in Tehran between March and August 2026. Convenience sampling was used; accordingly, among patients presenting during the specified period, those who met the inclusion criteria and provided informed consent to participate in the study were enrolled. The inclusion criteria were age between 18 and 65 years; being a candidate for head and neck surgery at Amir A'lam Hospital; ability to read, comprehend, and respond to the questionnaires; provision of written informed consent to participate in the study; absence of a history of severe psychiatric disorders, such as schizophrenia or bipolar disorder, based on medical records or self-report; and absence of cognitive impairment or neurological disease that could interfere with responding to the questionnaires. The exclusion criteria included withdrawal from participation at any stage of the study; occurrence of severe intraoperative or postoperative complications that prevented continued participation in the study; incomplete questionnaires; or failure to complete the research instruments.

The sample size was calculated using G*Power version 3.1 based on multiple linear regression with three predictor variables, a medium effect size ($f^2 = 0.15$), a significance level of .05, and statistical power of .80. Accordingly, the minimum required sample size was determined to be 77 participants. Given the possibility of participant attrition,

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incomplete questionnaires, and exclusion of cases with missing data, a sample size exceeding the calculated minimum was considered. Ultimately, data from 88 eligible patients with complete information were included in the statistical analyses. Subsequently, patients' pain intensity on the first postoperative day was assessed and recorded using the Visual Analog Scale (VAS).

The present study was conducted after obtaining the necessary permissions and approval from the Research Ethics Committee of the Islamic Azad University, Tehran Medical Sciences Branch, under ethics code IR.IAU.TMU.REC.1405.214. Following receipt of ethical approval and authorization from Amir A'lam Hospital, the data collection process was initiated.

Pain Catastrophizing Scale: The Pain Catastrophizing Scale was developed by Sullivan, Bishop, and Pivik (1995). This instrument is used to assess exaggerated negative thoughts, appraisals, and cognitive and emotional responses that individuals experience during actual or anticipated pain. The scale consists of 13 items, and respondents indicate, based on their previous painful experiences, the extent to which they experience each of the described thoughts or feelings when confronted with pain. Sullivan et al. (1995) reported the initial psychometric properties of the instrument. Each of the 13 items is rated on a five-point scale ranging from 0 ("not at all") to 4 ("all the time"). The standard version of the instrument contains no reverse-scored items. The total score is obtained by summing the scores of the 13 items; therefore, the total score ranges from 0 to 52. Higher scores indicate greater pain catastrophizing. No single diagnostic cutoff score applicable across all populations has been established for this scale, and scores should therefore be interpreted according to the purpose of the study and characteristics of the sample. In the original structure, three subscales were identified. The "rumination" subscale consists of Items 8, 9, 10, and 11 and has a score range of 0 to 16. The "magnification" subscale consists of Items 6, 7, and 13 and has a score range of 0 to 12. The "helplessness" subscale consists of Items 1, 2, 3, 4, 5, and 12 and has a score range of 0 to 24. In the present study, consistent with the two-factor structure confirmed in the Persian validation study by Rahmati et al. (2017), the "magnification" factor comprised Items 2, 3, 4, 5, 6, 7, and 13, while the "rumination/hopelessness" factor comprised Items 1, 8, 9, 10, 11, and 12. The theoretical score range for magnification is 0 to 28, and the theoretical score range for rumination/hopelessness is 0 to 24. In the original study by Sullivan et al. (1995), Cronbach's alpha for the total score was reported as .87. Cronbach's alpha coefficients for the rumination, magnification, and helplessness subscales were .87, .60, and .79, respectively. Test-retest reliability for the total score was also reported to be approximately .75. Significant associations between scale scores and pain intensity, negative affect, and other pain-related indicators provided appropriate evidence for the construct validity of the instrument. These findings were reported by Sullivan et al. (1995). Rahmati et al. (2017) examined the psychometric properties of the Persian version of the scale in 195 Iranian patients with chronic pain. Cronbach's alpha was .89 for the total score, .86 for the magnification factor, and .80 for the rumination/hopelessness factor. Two-week test-retest coefficients were reported as .81 for the total score, .80 for magnification, and .73 for rumination/hopelessness. Significant correlations between scale scores and pain intensity, impairment in daily functioning, physical disability, depression, anxiety, negative affect, and pain self-efficacy also supported the satisfactory convergent and discriminant validity of the Persian version.

Self-Compassion Scale–Short Form: The short form of the Self-Compassion Scale was developed by Raes, Pommier, Neff, and Van Gucht (2011) based on the original 26-item Self-Compassion Scale. This form contains 12 items and is used to assess overall self-compassion and its six principal components. The short form was designed to preserve the conceptual structure of the long form while using fewer items. Responses are recorded on a five-point Likert scale ranging from 1 ("almost never") to 5 ("almost always"). Items 1, 4, 8, 9, 11, and 12 are reverse-scored; that is, a score of 1 is converted to 5, 2 to 4, 3 remains unchanged, 4 is converted to 2, and 5 to 1. The total score is obtained by summing the scores of the 12 items, with a theoretical range of 12 to 60. Higher scores indicate greater self-compassion. The scale consists of six two-item subscales. "Self-kindness" consists of Items 2 and 6. "Self-judgment" consists of Items 11 and 12. "Common humanity" consists of Items 5 and 10. "Isolation" consists of Items 4 and 8. "Mindfulness" consists of Items 3 and 7, and "over-identification" consists of Items 1 and 9. The summed score

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for each subscale ranges from 2 to 10. Self-judgment, isolation, and over-identification represent the negative poles of the construct; therefore, the items corresponding to these three components are reverse-scored when calculating the overall score. If the mean score of each subscale is reported, the possible mean ranges from 1 to 5. Raes et al. (2011), in their development and validation studies of the short form, reported satisfactory internal consistency. Cronbach's alpha for the total score was .86 in the examined samples, and the correlation between the short and long forms of the scale was .97. Confirmatory factor analysis also supported the same six-factor structure as the long form, together with a higher-order self-compassion factor. These findings indicate that the short form can provide an adequate estimate of overall self-compassion. Shahbazi et al. (2015) examined the factor structure of the 12-item Persian version. Cronbach's alpha for the total scale was .91, and alpha coefficients for the six factors ranged from .77 to .92. The concurrent validity coefficient between the total score and the General Health Questionnaire was −.45, while coefficients for the subscales ranged from −.28 to −.48. Confirmatory factor analysis also confirmed the six-factor structure of the instrument in an Iranian sample. Therefore, the Persian version demonstrates acceptable validity and reliability.

Leahy Emotional Schema Scale–Short Form: The Leahy Emotional Schema Scale was designed to assess individuals' beliefs, appraisals, and strategies for dealing with their emotions. The second and abbreviated version of this scale was introduced by Robert Leahy in 2012 and consists of 28 items. This version is a shortened and revised form of the original 50-item scale and assesses various dimensions of adaptive and maladaptive emotional schemas. Items are rated on a six-point Likert scale ranging from 1 ("very untrue of me") to 6 ("very true of me"). According to the standard scoring key for the short form, Items 4, 6, 14, 15, 19, 24, 25, and 26 are reverse-scored; for these items, the transformed score is calculated as "7 minus the response score." When an overall directionally aligned score is calculated, the theoretical total score ranges from 28 to 168, with higher scores indicating more maladaptive emotional beliefs and schemas. No single, well-established diagnostic cutoff score has been reported for this instrument. Within its original theoretical framework, the 28-item version covers 14 emotional schemas, including invalidation, incomprehensibility, guilt, simplistic view of emotion, devaluation of emotion, loss of control, numbness, excessive rationality, duration of emotion, low consensus, blame, nonacceptance of feelings, rumination, and low expression of emotion. Each of these dimensions is theoretically assessed by two items. In the Persian validation study, Sharifi et al. (2024) confirmed an eight-factor structure for an Iranian sample. The "invalidation/loss of control" factor consists of Items 3, 5, 10, 12, and 17, with a summed score range of 5 to 30. The "excessive rationality" factor consists of Items 4, 7, 11, 24, and 27, with a range of 5 to 30. The "simplistic view of emotion" factor consists of Items 2, 13, 23, and 28, with a range of 4 to 24. The "numbness" factor consists of Items 8, 14, 15, and 20, with a range of 4 to 24. The "blame" factor consists of Items 19, 21, and 26, with a range of 3 to 18. The "low consensus" factor consists of Items 1, 6, and 25, with a range of 3 to 18. The "rumination" factor consists of Items 9 and 16, with a range of 2 to 12, and the "nonacceptance of feelings" factor consists of Items 18 and 22, with a range of 2 to 12. In the present study, the emotional schema subscales were also calculated according to this eight-factor structure of the Persian version. International studies have examined the psychometric properties of the short form across different cultural contexts. Batmaz and Özdel (2015), in the Turkish version, reported a total Cronbach's alpha coefficient of approximately .76 and obtained satisfactory evidence for the validity and reliability of the instrument. In addition, Suh et al. (2019) reported a more abbreviated factor structure in a sample of Korean university students. Differences in factor structures across cultures suggest that the organization of emotional schemas may, to some extent, be influenced by cultural context. Sharifi et al. (2024) examined the psychometric properties of the Persian version of the short-form Emotional Schema Scale among Iranian university students. Confirmatory factor analysis supported an eight-factor structure, and no items were removed because of inadequate factor loadings. Cronbach's alpha for the total scale was reported as .73. Cronbach's alpha coefficients for the invalidation/loss of control, excessive rationality, simplistic view of emotion, numbness, blame, low consensus, rumination, and nonacceptance of feelings factors were .71, .73, .68, .69, .71, .76, .75, and .72,

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respectively. In addition, assessment of face validity, content validity, and construct validity yielded satisfactory results, and the eight-factor structure of the instrument was considered acceptable for research use in Iranian samples.

Visual Analog Scale for Pain (VAS): The Visual Analog Scale (VAS) is a commonly used self-report instrument for assessing pain intensity in clinical and research settings, particularly for the evaluation of acute postoperative pain. The scale is presented as a 10-cm horizontal line, one end representing "no pain" and the other representing the "worst pain imaginable." The patient indicates the intensity of pain by marking a point on this line. In the present study, patients' pain intensity on the first postoperative day was measured using the VAS. Patients were asked to mark a point on the 10-cm line that represented the intensity of pain they were experiencing at that moment. The distance from the beginning of the line to the marked point was then measured and recorded as a score from 0 to 10, with higher scores indicating greater severity of acute postoperative pain. This score was used as the index of the dependent variable in the statistical analyses of the study.

The collected data were analyzed using SPSS version 28. Simultaneous multiple linear regression was employed, such that all predictor variables were entered into the regression model simultaneously, and the relative contribution of each variable to the prediction of pain severity was examined.

3. Findings and Results

Of the 88 participants, 51 (57.95%) were women and 37 (42.05%) were men; therefore, women constituted a larger proportion of the sample. Regarding educational level, the highest frequency was observed among participants with a high school diploma, comprising 35 individuals (39.77%). This was followed by those with less than a high school diploma, with 28 participants (31.82%), and those with a bachelor's degree, with 15 participants (17.05%). The lowest frequency was observed among participants with a doctoral degree, comprising only one participant (1.14%). Regarding marital status, 67 participants (76.14%) were married and 21 (23.86%) were single. These findings describe only the demographic characteristics of the sample and do not imply statistically significant differences between the demographic groups.

Table 1

Descriptive Statistics for the Main Study Variables and Their Subscales

Variable	Mean	SD
Acute postoperative pain severity	5.49	2.42
Pain catastrophizing – Total score	34.59	8.15
Magnification	16.40	5.89
Rumination/Hopelessness	18.19	3.46
Self-compassion – Total score	39.77	6.65
Self-kindness	7.57	2.00
Self-judgment	5.58	2.24
Common humanity	7.30	1.99
Isolation	6.58	2.35
Mindfulness	6.94	1.91
Over-identification	5.81	2.35
Maladaptive emotional schemas – Total score	93.38	13.82
Invalidation/Loss of control	15.53	5.04
Excessive rationality	15.23	3.94
Simplistic view of emotion	12.94	3.28
Numbness	13.24	4.24
Blame	8.86	2.79
Low consensus	11.52	3.40
Rumination	7.70	2.80
Nonacceptance of feelings	8.34	2.76

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As shown in Table 1, the mean severity of acute postoperative pain was 5.49 (*SD* = 2.42). The mean total score for pain catastrophizing was 34.59 (*SD* = 8.15), with mean scores of 16.40 (*SD* = 5.89) for magnification and 18.19 (*SD* = 3.46) for rumination/hopelessness. The mean total self-compassion score was 39.77 (*SD* = 6.65). Among its subscales, self-kindness had a mean of 7.57 (*SD* = 2.00), self-judgment 5.58 (*SD* = 2.24), common humanity 7.30 (*SD* = 1.99), isolation 6.58 (*SD* = 2.35), mindfulness 6.94 (*SD* = 1.91), and over-identification 5.81 (*SD* = 2.35). The mean total score for maladaptive emotional schemas was 93.38 (*SD* = 13.82). Among the emotional-schema dimensions, invalidation/loss of control and excessive rationality had means of 15.53 (*SD* = 5.04) and 15.23 (*SD* = 3.94), respectively, whereas the remaining subscale means ranged from 7.70 to 13.24.

Prior to conducting the inferential analyses, the assumptions underlying multiple linear regression were examined. The Shapiro–Wilk test indicated statistically significant deviations from raw-score normality for acute postoperative pain severity, $W = .962$, $p = .011$, and pain catastrophizing, $W = .950$, $p = .002$, whereas self-compassion, $W = .987$, $p = .563$, and maladaptive emotional schemas, $W = .981$, $p = .217$, did not significantly deviate from normality. Nevertheless, skewness values ranged from −0.313 to 0.422 and kurtosis values ranged from −0.911 to −0.109, indicating that the distributions did not exhibit substantial departures from symmetry or excessive kurtosis. Examination of regression diagnostics further showed a Durbin–Watson statistic of 1.443, suggesting an acceptable degree of independence of residuals, although some caution is warranted. The maximum Mahalanobis distance was 9.627, which was below the critical value of 16.266 at $p = .001$, and the maximum Cook's distance was .066, indicating no evidence of highly influential multivariate outliers. Multicollinearity was also within acceptable limits: tolerance values were .691 for pain catastrophizing, .608 for self-compassion, and .673 for emotional schemas, while the corresponding variance inflation factor (VIF) values were 1.446, 1.645, and 1.486, respectively. Taken together, these diagnostics indicated that the assumptions required for multiple regression analysis were sufficiently satisfied.

Table 2

Pearson Correlation Matrix Among the Main Study Variables

Variable	1	2	3	4
1. Pain catastrophizing	1	—	—	—
2. Self-compassion	−.522**	1	—	—
3. Emotional schemas	.442**	−.541**	1	—
4. Acute postoperative pain severity	.232*	−.179	.276**	1

As presented in Table 2, pain catastrophizing was significantly and positively correlated with acute postoperative pain severity, $r = .232$, $p < .05$, indicating that greater pain catastrophizing was associated with greater postoperative pain intensity. Emotional schemas were also significantly and positively associated with acute postoperative pain severity, $r = .276$, $p < .01$. In contrast, the correlation between self-compassion and acute postoperative pain severity was negative but not statistically significant, $r = −.179$. Significant associations were also observed among the predictor variables. Pain catastrophizing was negatively correlated with self-compassion, $r = −.522$, $p < .01$, and positively correlated with maladaptive emotional schemas, $r = .442$, $p < .01$. Self-compassion was negatively correlated with maladaptive emotional schemas, $r = −.541$, $p < .01$. Although these intercorrelations were moderate, the collinearity diagnostics indicated that they did not reach levels likely to compromise the stability of the regression estimates.

Table 3

Multiple Regression Model Summary and Regression Coefficients for Predicting Acute Postoperative Pain Severity

Model/Variable	B	SE B	β	*t*	*p*
Constant	0.200	3.691	—	0.054	.957
Pain catastrophizing	0.042	0.037	.141	1.129	.262

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Self-compassion	0.005	0.048	.015	0.111	.912
Emotional schemas	0.039	0.022	.222	1.751	.084

Model summary statistic	Value
Multiple correlation coefficient (R)	.302
Coefficient of determination (R^2)	.091
Adjusted R^2	.059
Standard error of the estimate	2.344
F	2.817
Degrees of freedom	3, 84
Model p value	.044

As shown in Table 3, the multiple regression model including pain catastrophizing, self-compassion, and emotional schemas significantly predicted acute postoperative pain severity, $F(3, 84) = 2.817$, $p = .044$. The multiple correlation coefficient was $R = .302$, and the coefficient of determination was $R^2 = .091$, with an adjusted R^2 of .059. Thus, the three predictor variables jointly explained 9.1% of the variance in acute postoperative pain severity, indicating a statistically significant but relatively limited overall explanatory contribution. Examination of the individual regression coefficients showed that pain catastrophizing had a positive standardized coefficient, $\beta = .141$, but its unique contribution was not statistically significant, $t = 1.129$, $p = .262$. Self-compassion also failed to make a significant independent contribution, $\beta = .015$, $t = 0.111$, $p = .912$. Emotional schemas demonstrated the largest standardized coefficient among the three predictors, $\beta = .222$, and approached statistical significance; however, its independent effect did not reach the conventional .05 threshold, $t = 1.751$, $p = .084$. Accordingly, the overall regression model was statistically significant, whereas none of the individual predictors independently accounted for a statistically significant proportion of variance in postoperative pain severity after controlling for the other two predictors.

4. Discussion and Conclusion

The present study investigated the extent to which pain catastrophizing, self-compassion, and emotional schemas predicted the severity of acute postoperative pain among patients undergoing head and neck surgery. The findings showed that the three predictor variables, when entered simultaneously into the regression model, significantly predicted acute postoperative pain severity. However, the overall explanatory power of the model was modest, accounting for 9.1% of the variance in postoperative pain. At the bivariate level, pain catastrophizing was significantly and positively correlated with acute postoperative pain, and emotional schemas were also significantly and positively associated with pain severity. Self-compassion showed a negative association with postoperative pain, but this relationship was not statistically significant. When the three predictors were entered simultaneously into the multiple regression model, none made a statistically significant unique contribution after controlling for the other variables, although emotional schemas showed the largest standardized coefficient and approached statistical significance. These findings suggest that cognitive-emotional factors are relevant to the subjective experience of acute postoperative pain, but their effects may overlap with one another and are likely embedded within a broader set of physiological, surgical, anesthetic, and contextual determinants. This interpretation is consistent with contemporary biopsychosocial models of pain, which emphasize that postoperative pain is not solely a direct consequence of tissue damage but emerges from interactions among nociceptive processes, prior experiences, cognitive appraisal, emotional regulation, expectations, coping responses, and clinical circumstances (1-3).

The significant positive association between pain catastrophizing and acute postoperative pain observed in the present study is consistent with a substantial body of previous research. Pain catastrophizing reflects a maladaptive pattern characterized by magnification of pain-related threat, persistent rumination about pain, and a sense of helplessness in coping with painful experiences. These processes may heighten selective attention to nociceptive signals, increase anticipatory anxiety, amplify negative affect, and reduce the perceived capacity to control or tolerate pain. In surgical populations, higher catastrophizing

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has repeatedly been associated with greater postoperative pain intensity and less favorable recovery. Usta et al. found that pain catastrophizing was related to both pain intensity and postoperative mobility following laparoscopic abdominal surgery, indicating that catastrophic thinking may influence not only symptom perception but also early functional recovery (14). Wang et al. similarly showed that pain catastrophizing played a mediating role in the relationship between pain sensitivity and acute postoperative pain after abdominal surgery, suggesting that cognitive interpretation partly explains why some individuals experience stronger pain responses to comparable nociceptive input (15). The present finding also aligns with evidence from orthopedic surgery. Higher catastrophizing has been associated with more severe postoperative pain during the first week after rotator cuff repair (16), as well as with acute postoperative pain after unicompartmental knee arthroplasty (17). Furthermore, Aalders et al. demonstrated that pain catastrophizing was associated with subjective pain and function following total hip arthroplasty, underscoring the broader relevance of this construct to postsurgical outcomes (18). Collectively, these findings support the interpretation that patients who habitually magnify the threat value of pain or become cognitively preoccupied with pain may experience greater acute postoperative pain.

The lack of a statistically significant unique effect of pain catastrophizing in the simultaneous regression model does not necessarily contradict these previous findings. In the current data, pain catastrophizing was moderately correlated with both self-compassion and emotional schemas, suggesting that part of its relationship with postoperative pain may be shared with broader patterns of emotional regulation and self-related coping. Catastrophizing may therefore exert its influence not as an isolated process but as one component within a wider cognitive-emotional system. This interpretation is supported by research showing that catastrophizing is closely related to anxiety sensitivity, emotion regulation, cognitive flexibility, and experiential avoidance (12). It is also consistent with evidence that metacognitive interventions can reduce catastrophizing in clinical pain populations, implying that catastrophic thinking is intertwined with broader beliefs about cognition and emotion (13). Research in chronic pain has likewise shown that catastrophizing is associated with working memory performance and pain acceptance, further illustrating the interconnected nature of cognitive appraisal and adaptation to pain (11). Therefore, the nonsignificant unique regression coefficient in the present study may reflect statistical overlap rather than an absence of clinical relevance.

The significant positive relationship between maladaptive emotional schemas and acute postoperative pain severity represents another important finding of the study. Emotional schemas refer to individuals' beliefs about the meaning, legitimacy, controllability, duration, and acceptability of emotional experiences. According to emotional schema theory, people differ in whether they interpret emotions as understandable and manageable or as dangerous, uncontrollable, shameful, invalid, or unacceptable (30). When emotional schemas are maladaptive, individuals may respond to distress with rumination, suppression, blame, excessive rationalization, avoidance, or fear of losing control. In the context of surgery, such beliefs may intensify the emotional response to pain and amplify the subjective experience of postoperative discomfort. For example, a patient who interprets fear or vulnerability as unacceptable may engage in greater suppression or internal conflict, while a patient who believes distress is uncontrollable may become more vigilant to painful sensations. Such mechanisms can increase physiological arousal and reduce adaptive coping, thereby contributing to greater pain perception.

The present findings regarding emotional schemas are consistent with emerging evidence linking emotional-schema processes to symptom severity and pain-related outcomes. Topaloğlu and Puşuroğlu reported that metacognitive and emotional schemas were associated with symptom severity in patients with fibromyalgia, suggesting that beliefs about emotional experience may play an important role in how bodily symptoms are perceived and interpreted (32). Abdollahpour et al. also found that emotional schemas were associated with intolerance of uncertainty and that experiential avoidance served as an important mediating mechanism, highlighting the role of maladaptive emotional beliefs in responses to ambiguity and distress (31). In chronic low back pain, emotional schemas have been incorporated into models of pain outcomes together with mood and anxiety symptoms, experiential avoidance, and self-compassion (27). These findings support

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the present result by suggesting that emotional schemas may contribute to pain not simply through emotional intensity itself but through the ways in which emotions are evaluated, regulated, and tolerated. The relatively larger standardized coefficient for emotional schemas in the current regression model may indicate that beliefs about emotional experiences are particularly relevant in the immediate postoperative context, where uncertainty, dependence, fear, and loss of control can be pronounced.

The relationship between emotional schemas and postoperative pain may also be understood in light of evidence showing that psychological vulnerability contributes to pain outcomes in head and neck surgical populations specifically. Habib et al. found that mental health risk factors were associated with postoperative pain among patients undergoing head and neck free flap reconstruction, suggesting that psychological characteristics can meaningfully influence pain in this complex surgical context (8). Earlier studies in patients undergoing head and neck cancer surgery have also emphasized the difficulty of achieving adequate postoperative pain control and the substantial variability in pain experience across patients (6, 7). Head and neck surgery may be especially psychologically demanding because it can affect appearance, swallowing, speech, breathing, and basic daily functioning. In oncological cases, concerns about diagnosis, prognosis, and recurrence may further intensify emotional distress. Under such circumstances, maladaptive emotional schemas may increase the likelihood that postoperative sensations and emotions are interpreted as threatening, uncontrollable, or intolerable, thereby contributing to greater perceived pain.

In contrast to pain catastrophizing and emotional schemas, self-compassion was not significantly associated with acute postoperative pain severity in the present study, although the direction of the correlation was negative. This finding suggests that greater self-compassion may tend to accompany lower pain but may not have a sufficiently strong direct relationship with pain intensity during the immediate postoperative period. One possible explanation is that self-compassion is more strongly associated with psychological adjustment, emotional distress, pain acceptance, and coping than with the sensory intensity of acute pain itself. Meta-analytic evidence indicates that self-compassion is robustly associated with lower psychological distress in chronic illness (23), and research in chronic pain populations has linked self-compassion to a range of favorable psychological and pain-related outcomes (24). Djurovic also emphasized both psychological and physiological benefits of self-compassion in chronic illness, suggesting that self-compassion may operate through stress regulation and adaptive coping rather than through immediate suppression of nociceptive intensity (25). Thus, in the context of the first postoperative day, the direct effects of surgery, tissue injury, anesthesia, analgesic medication, and inflammatory processes may dominate the pain experience to such an extent that the protective influence of self-compassion on raw pain intensity becomes relatively small.

The nonsignificant finding for self-compassion should also be interpreted in light of evidence that self-compassion may influence pain indirectly through other cognitive and emotional mechanisms. Ardalanifarsa et al. incorporated self-compassion as a mediating variable in a model linking emotional schemas, mood and anxiety symptoms, experiential avoidance, and pain outcomes in patients with chronic low back pain (27). Trunfio et al. similarly demonstrated that self-compassion operates within a broader network involving alexithymia and pain catastrophizing in fibromyalgia (28). These studies suggest that self-compassion may not function as a simple direct predictor of pain severity but instead may modify the way individuals respond to distress, catastrophic thoughts, or emotionally difficult experiences. This interpretation is further supported by intervention studies. Self-compassion training has been shown to reduce pain catastrophizing and improve distress tolerance (22), while compassion-based interventions have also produced improvements in pain-related cognitive and behavioral outcomes (20, 21). Therefore, self-compassion may be more important as a buffering or mediating factor than as a direct determinant of acute pain intensity.

The observed negative correlations between self-compassion and both pain catastrophizing and maladaptive emotional schemas further support this interpretation. Individuals with greater self-compassion may be less likely to engage in harsh self-judgment, emotional overidentification, or catastrophic interpretation of pain. This is conceptually consistent with the idea that self-compassion promotes a more balanced and accepting stance

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toward suffering. Research in women with chronic pain has shown that self-compassion is positively associated with adaptive interpersonal and self-related outcomes, including communication skills, self-worth, and social self-efficacy (26). Although these outcomes differ from acute postoperative pain, they reflect the broader capacity of self-compassion to support psychological resilience. Similarly, intervention research has shown that self-compassion-oriented approaches can modify impulsivity and emotional responses in distressed populations (29). Consequently, self-compassion may remain clinically relevant even though it did not independently predict postoperative pain severity in this study.

The relatively modest explanatory power of the regression model is itself an important finding. The three psychological variables explained 9.1% of the variance in acute postoperative pain, indicating that although cognitive-emotional characteristics contribute to pain perception, most of the variance is attributable to other factors. Acute postoperative pain is strongly influenced by surgical site, extent of tissue injury, duration and type of surgery, anesthetic technique, analgesic regimen, inflammatory response, previous pain history, individual pain sensitivity, and other biological and clinical variables (1-3). Studies comparing pharmacological approaches to postoperative pain control demonstrate the substantial impact of analgesic strategies on pain intensity (35, 36). Accordingly, it would be unrealistic to expect psychological variables alone to account for a large proportion of early postoperative pain variance. Rather, their contribution should be understood as complementary to medical and surgical determinants.

The overall pattern of the findings is therefore consistent with a biopsychosocial interpretation of acute postoperative pain. Psychological factors such as catastrophizing and maladaptive emotional schemas appear to be meaningfully associated with postoperative pain, but their unique effects may become attenuated when considered simultaneously because they are interrelated and because acute pain is heavily influenced by biomedical factors. The current findings are also compatible with research demonstrating that psychological interventions can improve pain coping, pain self-efficacy, and emotional functioning across different pain conditions (9, 10, 33). In addition, findings on empathy, perceived social support, and mentalization in chronic pain emphasize that pain experience is embedded within broader emotional and interpersonal systems (34). Taken together, the results support the view that cognitive-emotional assessment may add useful information to conventional clinical assessment of patients undergoing head and neck surgery, even when its direct contribution to explaining pain intensity is relatively limited.

Several limitations should be considered when interpreting the findings. First, the study used a convenience sample recruited from a single hospital, which may limit the generalizability of the findings to other medical centers, surgical populations, or cultural contexts. Second, the sample size, although adequate for the planned regression analysis, was relatively modest and may have limited the statistical power to detect small independent effects, particularly when the predictor variables were moderately correlated with one another. Third, the predictor variables were measured using self-report questionnaires and may therefore have been affected by response bias, social desirability, or temporary emotional states before surgery. Fourth, postoperative pain was assessed only on the first day after surgery, so the findings cannot determine whether the same psychological variables predict pain trajectories over subsequent days or the transition from acute to persistent postsurgical pain. Fifth, potentially important clinical variables, including type and duration of surgery, extent of tissue injury, diagnosis, preoperative pain, opioid or analgesic use, anesthetic technique, postoperative complications, and individual pain sensitivity, were not incorporated into the predictive model. Finally, the correlational design does not allow causal conclusions regarding the direction of relationships among pain catastrophizing, self-compassion, emotional schemas, and postoperative pain.

Future studies should replicate these findings using larger, multicenter samples and should examine more heterogeneous groups of patients undergoing different types of head and neck procedures. Longitudinal designs are recommended to assess pain repeatedly from the preoperative period through the early and later stages of recovery and to determine whether cognitive-emotional variables predict pain trajectories, analgesic requirements, functional recovery, or persistent postsurgical pain. Future models should simultaneously include relevant clinical and

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biological variables, such as surgical complexity, duration of surgery, preoperative pain severity, medication use, anesthetic technique, inflammatory indicators, and pain sensitivity, in order to estimate the incremental predictive value of psychological factors beyond conventional medical predictors. It would also be useful to test mediation and moderation models to determine whether self-compassion buffers the effects of catastrophizing or maladaptive emotional schemas on postoperative pain and whether experiential avoidance, anxiety, or pain self-efficacy mediate these relationships. Experimental and intervention studies could further examine whether preoperative psychological interventions targeting catastrophic thinking, emotional schemas, mindfulness, or self-compassion can reduce acute postoperative pain and improve recovery outcomes.

From a practical perspective, the findings suggest that psychological screening may be incorporated into preoperative assessment for patients undergoing head and neck surgery, particularly for identifying individuals with high levels of pain catastrophizing or maladaptive emotional schemas. Brief validated questionnaires could help clinicians recognize patients who may be at greater risk for experiencing more severe postoperative pain and who may benefit from additional preparation before surgery. Preoperative education could include realistic information about expected pain, strategies for interpreting postoperative sensations, emotional regulation techniques, and methods for reducing catastrophic thinking. Patients with marked psychological vulnerability may also benefit from brief psychological interventions focused on coping, acceptance, emotional awareness, and self-compassion alongside standard pharmacological pain management. Such approaches should not replace medical analgesia but could complement multimodal pain management by addressing the cognitive and emotional processes that shape the subjective experience of pain and potentially improve patients' overall postoperative adjustment.

Authors' Contributions

All authors equally contributed to the study and to manuscript development, and all approved the final version.

Declaration

The authors declare that artificial intelligence tools were used only to assist with language editing, translation, and improvement of the manuscript's readability. All conceptualization, study design, data collection, data analysis, interpretation of findings, and final approval of the manuscript were performed by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the content.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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