


# BMJ Open Do difficulties in emotional processing predict procedure pain and shape the patient's colonoscopy experience?

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## ABSTRACT

**Objectives** Pain and fear of colonoscopy are inter-related; they make the colonoscopy experience unpleasant and impede adherence to colorectal cancer screening and prevention campaigns. According to previous research, fear and pain have been found to depend on patients' maladaptive cognitions and exaggerated emotional responses. The present study investigated whether emotional processing difficulties predicted colonoscopy pain and the associated catastrophising thoughts.

**Design** Prospective, observational, blinded.

**Method** A sample of 123 patients was assessed for specific emotional processing difficulties (ie, suppression of emotions, unprocessed emotions, failure to control emotions, avoidance of emotional triggers and impoverished emotional experience) and anxiety-related variables (ie, worry, anxiety and depression) before colonoscopy. A trained medical doctor rated patients' behavioural manifestations of pain during colonoscopy. After complete recovery from sedation, the patients rated the endoscopy experience using perceived pain and situation-specific pain catastrophising scales.

**Results** About half of the patients were above the cut-off for anxiety before the procedure. Notwithstanding sedation, behavioural manifestations of pain during colonoscopy indicated probable or moderate pain for about one-third of the patients. Failure to control emotions, poor emotional experience and avoiding emotional triggers were positively correlated with behavioural manifestations of pain, self-reported pain and pain catastrophising. Regression analyses, controlling for gender, age, colonoscopy experience and sedation, revealed that avoidance of emotional triggers uniquely contributed to predicting pain outcomes.

**Conclusions** Early identification of emotional processing difficulties associated with pain catastrophising can help define personalised psychological preparation paths to manage negative emotions in patients who fear colonoscopy pain.

## INTRODUCTION

Colonoscopy is a medical procedure conducted using a long, flexible fiberoptic tool to inspect the colon, take biopsies or remove precancerous lesions. A colonoscopy lasts, on average, 30 min and can be performed under conscious sedation. Complications are

## Strengths and limitations of this study

- Emotional processing difficulties assessed before endoscopy were positively correlated with behavioural manifestations of pain, self-reported pain and pain catastrophising.
- Regression analyses revealed that avoidance of emotional triggers made a unique contribution to predicting pain catastrophising and pain outcomes.
- There were some inconsistencies across the three multiple regression analyses (clinician-rated pain, self-reported pain and catastrophising).

rare,<sup>1 2</sup> with less than a 1/1000 perforation rate, and are often associated with a polypectomy rather than the act itself.<sup>3</sup> Nevertheless, patients may experience mild-to-moderate pain during the procedure, and the prospect of inserting the colonoscope into the rectum and advancing it through the colon may cause fear and anxiety.<sup>4-6</sup> Colonoscopy screening every 10 years is recommended for everyone starting at age 50 to prevent colorectal cancer (CRC).<sup>7 8</sup> High-risk groups are advised to undergo endoscopic surveillance at a younger age and shorter intervals.<sup>9</sup> Notwithstanding this, adherence rates are low. Thus, while colonoscopy screening is effective and cost-effective, a large part of the eligible population (up to 30%–35%) remains unscreened.<sup>10 11</sup>

From the patient's perspective, an unspecified fear is a most frequently reported barrier to undergoing colonoscopy, followed by unpleasant preparation, lack of knowledge, pain and lack of insurance coverage or unaffordable costs.<sup>12</sup> Besides that, one-fifth of the patients reported one of the following fears: being diagnosed with cancer, having complications from an invasive procedure, being sedated and being a burden on family/friends.<sup>12</sup> Given subjective, primarily emotional, obstacles to colonoscopy, the European Society of Gastrointestinal Endoscopy

has included patient experience in a set of quality indicators to increase adherence and maximise colonoscopy outcomes.<sup>13 14</sup>

Unfortunately, there is no way to eliminate colonoscopy pain,<sup>15–17</sup> and identifying which patients will have a difficult time with the procedure is problematic.<sup>18 19</sup> Patient demographic characteristics are known to influence the experience of colonoscopy pain. For instance, female gender and younger age are associated with greater pain during and after the procedure<sup>20–22</sup> However, a low subjective pain threshold, negative attitudes and maladaptive cognitions can increase patients' fears and exacerbate pain.<sup>5 22 23</sup>

One extensively studied maladaptive cognition is pain catastrophising (PC), a mindset of exaggerated negative thoughts and emotional schemas that describe people's beliefs, appraisals and feelings related to actual or expected pain experience.<sup>24</sup> Specifically, PC amplifies pain and fear of its negative consequences, triggers ruminative thoughts about pain and impairs the patient's ability to cope with painful situations.<sup>25</sup> Not only has PC been linked to perceived pain intensity and disability, but also to the severity of depression and anxiety states.<sup>26</sup> During the past decade, research has addressed the relationship between PC and pain in aversive medical procedures.<sup>27</sup> For example, PC predicted postoperative pain intensity in cardiac surgery,<sup>28</sup> anterior cruciate ligament repair<sup>29</sup> and hysterectomy,<sup>30</sup> to name a few. Several studies have investigated how PC can be modified to improve surgical outcomes; however, treatment effectiveness differed significantly between and within intervention strategies (eg, psychoeducation, cognitive-behavioural therapy).<sup>31</sup>

Emotional processing (EP) is a psychological construct used to understand the subjective experience of fear in emotional disorders. EP theory describes how one spontaneously adapts to emotional events to reduce their psychological and physiological impact.<sup>32 33</sup> In this framework, emotional disturbances, including phobias, derive from excessive suppression, repression or avoidance of emotion.<sup>32 33</sup> According to a recent process model,<sup>34–37</sup> every emotion begins with a triggering event (or *input*), whose *cognitive* appraisal determines the valence and intensity of the subsequent *emotional* experience and eventually its expression through appropriate behaviours. The experience stage is essential to the process and determines the person's awareness of their feelings. Deficits in emotional awareness (eg, being confused about one's own feelings or unable to make sense of how one feels) increased anxiety and pain in chronic conditions.<sup>38</sup> Indeed, poor emotional awareness can foster generalised negative affect states, hyperarousal and hypervigilance towards physical states.<sup>39 40</sup> As a result, bodily sensations, including pain, are amplified and can be experienced as more unpleasant.

The process model also posits three maladaptive emotion regulation mechanisms. First, disregarding or purposely *avoiding* an emotional trigger is thought to delay the onset of the emotional experience. In treating

phobias, avoidance reduced the effects of cognitive interventions to change one's appraisal of fear through exposure therapy.<sup>41 42</sup> Similarly, colonoscopy patients who cognitively avoid the prospect of having to undergo the procedure to dismiss their fears may fail to integrate information aimed at reappraising the situation (eg, explaining the benefits of cancer screening and the safety of the procedure). Second, *suppressing* the emotional experience (eg, not allowing oneself to experience a focal emotion) can reduce distress in the short term, but, paradoxically, it increases emotional arousal in the long term.<sup>43 44</sup> Likewise, patients who have bottled up their emotions about colonoscopy may appear calm on the surface, but their arousal level may be high. Third, difficulties in *controlling* the behavioural expression of emotions can result in excessive, disorderly or inappropriate behavioural responses to emotional triggers.<sup>34–37</sup> Patients who have difficulties controlling emotions may suffer more severe, unpleasant sensations, such as creating voluntary or involuntary movements that interfere with the endoscopist's procedures.

In general, people can successfully deal with most emotional events in their lives. However, some situations are more likely to result in EP failures. For instance, facing an invasive medical procedure like a colonoscopy is an emotional trigger that is hard to process, as shown by the high prevalence of highly anxious, nervous or agitated patients.<sup>4 6</sup> On the other hand, some individuals can be resilient to stressful situations, even traumatic experiences. Others, however, may be more susceptible. The term 'emotional processing style' implies that everyone has a unique manner of dealing with and expressing emotions. Consequently, EP theory considers the significance of a precipitating event (eg, the colonoscopy) and patients' idiosyncratic vulnerabilities (eg, habitually avoiding emotional triggers, lacking emotional awareness or difficulties controlling emotions). However, such an EP style is malleable and can be successfully addressed by psychological interventions.<sup>45</sup>

Can EP and PC shape the patient's experience of colonoscopy? Previous research has overlooked the role of these variables in digestive endoscopy. Preliminary evidence from our research group suggests that fear of endoscopy might evolve into pain when patients cannot endure the procedural distress and cope with the associated negative emotions.<sup>46</sup> Previous studies have not investigated how EP difficulties foster pain and catastrophising thoughts during adverse medical procedures. At best, research has shown that EP difficulties are associated with the onset and severity of chronic pain.<sup>34 36 47</sup>

The present study used a prospective design in which EP difficulties were assessed for each patient before the procedure. Instead, clinician-rated pain and self-reported pain were assessed during and after colonoscopy, respectively. We tested whether EP difficulties like unprocessed emotions, controlling emotions, avoiding emotional triggers and lacking emotional awareness would predict greater colonoscopy pain and the associated

catastrophising thoughts. Moreover, hierarchical regression analyses were used to control confounding factors like patient characteristics (ie, gender, age, colonoscopy experience and sedation level) and anxiety-related variables (ie, procedure-related worry, anxiety and depression). After entering these groups of variables, the statistical significance of EP difficulties would support their unique contribution as predictors of pain outcomes.

Recent studies recommended assessing PC during or after the experience of noxious stimulations to capture situation-specific catastrophising thoughts associated with actual events.<sup>48</sup> Accordingly, we employed a 'situational' PC measure, administered before discharge, using endoscopy pain as the reference standard. The study timeline and the two-stage design (ie, pre-post colonoscopy) ensured that variations in the putative predictor variables existed before the occurrence of criterion variables, which is required to establish that EP difficulties can predict colonoscopy pain and pain catastrophising.

## METHODS

### Participants

Age over 18 years and knowledge of the Italian language were the inclusion criteria for the study. The exclusion criteria were: history of psychiatric disorders, use of antidepressants, adrenoreceptor antagonists or opioids, and current or recent chronic pain syndrome. The study was conducted according to the Ethical Code for Psychological Research of the Italian Association of Psychology and the Declaration of Helsinki on Human Rights. The final number of participants was 123. These were selected from 152 eligible outpatients referred for colonoscopy at the Endoscopy Unit at Sapienza University of Rome. Eleven of them (7.23%) declined to participate, and seven (4.60%) were excluded because of a history of psychiatric disorders or current use of medications. Seven (4.60%) and four (2.63%) patients did not answer questions about the pain after endoscopy and abandoned the completion of psychological scales before endoscopy, respectively.

The sample included 64 women and 59 men. Seventy-one (57.72%) patients had previous colonoscopy experience. The age of the sample ranged from 22 to 88 years ( $M=57.70$ ;  $SD=15.00$ ). The most common indications for colonoscopy were follow-up after surgery ( $n=38$ , 30.89%), CRC screening ( $n=29$ , 23.57%) and family history of CRC ( $n=17$ , 13.82%), investigation of rectal bleeding ( $n=19$ , 15.44%), bowel movement pattern change ( $n=11$ , 8.94%) and abdominal pain ( $n=8$ , 6.50%). The procedure lasted on average 20.20 min ( $SD=7.38$ ) and was performed using a standard endoscope with a midazolam–meperidine combination to obtain a conscious sedation. Patients received a dose of midazolam 0.07 mg/kg (maximum 2 mg if >70 years/comorbidities) in association with meperidine 50 mg (or 25 mg if <50 kg/>70 years/comorbidities). The body mass index (BMI) ranged from 19 to 40 kg/m<sup>2</sup> ( $M=25.99$ ;  $SD=4.16$ ). Considering the BMI normal range of 18–25, no patient was underweight, 45 were overweight

and 14 were obese (ie, BMI>30). Two exams were incomplete, and 42 patients had a negative diagnosis (34.14%). The remaining patients had diverticulosis ( $n=24$ ; 19.51%), polyps ( $n=24$ ; 19.51%), haemorrhoids ( $n=13$ ; 10.56%), Inflammatory Bowel Disease ( $n=12$ ; 9.75%), other conditions ( $n=3$ ; 2.43%) or neoplasia ( $n=3$ ; 2.43%).

### Procedure

A medical doctor and a psychologist invited the eligible patients to participate in a multidisciplinary study. After the patients' informed consent was received, the psychologist transferred the patients to a comfortable room and administered a booklet of psychological measures, including anxiety and depression, procedure-related worry and emotional processing difficulties (see instruments). The psychologist was in the room and assisted the patient on request. Each patient was assigned a progressive number to be delivered to the endoscopist in the operating room. The endoscopist checked for exclusion criteria, transcribed information from the patient's medical record and then proceeded to the colonoscopy. A second doctor (not always the same) rated the patient's behavioural manifestations of pain and sedation level during endoscopy. Although only one doctor rated the patient, all second doctors underwent supervised training in using the pain scale according to the items and examples provided in manual.<sup>49</sup> In group meetings, this information was discussed to standardise the pain assessment and attune the ratings. Notably, the medical team involved in the study was blinded to the patient's responses to psychological scales. After complete recovery from sedation, the endoscopist invited the patient to rate the pain experience and answer questions regarding situational PC, which were placed with the medical data in a sealed envelope on which the patient's serial number was transcribed.

### Variables and instruments

#### Anxiety and depression

The Hospital Anxiety and Depression Scale is a valid measure of health distress.<sup>50</sup> It includes seven anxiety and seven depression symptoms, each rated on a 4-point severity scale. In the present study, we used the validated Italian version.<sup>51</sup> Cronbach's alpha coefficients were 0.76, 0.62 and 0.82 for anxiety, depression and the total score. A subscale score higher than 7 is used to fast screen medical patients at risk for health anxiety and depression.<sup>52</sup>

#### Worry Questionnaire

This eight-item questionnaire was developed to capture maladaptive cognitions associated with preprocedural anxiety.<sup>53</sup> Four items refer to worries about the procedure (eg, When I'm waiting for a medical exam like this, I worry a lot), two address concerns about test results (eg, As soon as I finish a medical exam like this, I start to worry about the results), and two describe general health worries (eg, I have always been a person who worries about anything related to my health). A total score was



obtained by summing all the items, with a higher score indicating greater procedure-related worry (Cronbach's  $\alpha=0.92$ ).

### Emotional Processing

The Emotional Processing Scale (EPS-25) is a 25-item questionnaire developed to assess emotional processing difficulties in clinical and non-clinical populations.<sup>36</sup> EPS items apply to the way one felt or acted during the last week, and the temporal framework covered the days immediately before colonoscopy in our specific case. Each item uses a 10-point visual analogue rating scale, ranging from 0 (completely disagree) to 9 (completely agree). The EPS produces five subscale scores by averaging the five items of suppression ( $\alpha=0.75$ ), unprocessed ( $\alpha=0.77$ ), controllability ( $\alpha=0.77$ ), avoidance ( $\alpha=0.73$ ) and emotional experience ( $\alpha=0.78$ ). In all cases, higher scores indicated greater emotional processing difficulties.

### Clinician-rated pain

Behavioural manifestations of pain during colonoscopy were evaluated using the Pain Assessment in Advanced Dementia Scale (PAINAD).<sup>49</sup> Not requiring communication with the patient, the PAINAD can be completed by an observer in the operating room to rate ostensible manifestations of pain, such as breathing, negative vocalisations, facial expression, body language and consolability. A total score of 0–10 was obtained in the current study, with higher scores indicating more severe pain ( $\alpha=0.90$ ). A score above 2 indicates possible pain, whereas a score above 4 indicates moderate pain.<sup>54</sup>

### Patient-reported pain

We used visual-analogue, numeric, verbal and face scales to assess perceived pain associated with the procedure. The Visual Analogue Scale was used to ask the patient to make a mark on a segment of 10 cm in length that went from 'no pain' to 'worst imaginable pain'. A continuous score was obtained, measuring the distance between the patient's response and the zero of the scale. The numeric scale was used to ask the patient to assess how painful the procedure was using integer numbers from 0 to 10, with higher numbers indicating lower pain intensity. The verbal scale included five descriptors placed in a ranked order. Very severe, severe, moderate, mild, very mild and no pain categories were coded with numbers ranging from 5 to 0. Last, patients were asked to report the experience of pain, selecting from six draws of facial expressions of pain.

### Situational pain catastrophising

To assess catastrophising thoughts occurring during colonoscopy, we modified the items included in the Italian version of the pain catastrophising scale.<sup>55</sup> We changed the instructions (ie, describe your feelings and thoughts *during your colonoscopy experience*) and reworded the items in the past tense (eg, I *was* preoccupied about when the *colonoscopy* pain *would* end). The patients were asked to refer to thoughts, feelings and physical sensations

experienced during the procedure. We obtained a total score for situational pain-catastrophizing ( $\alpha=0.94$ ).

### Sedation level

We used the Ramsay Sedation Scale,<sup>56</sup> a clinician rating scale describing the patient's state during colonoscopy according to six levels from 1 (ie, ostensibly agitated or restless) to 6 (ie, entirely unconscious or not arousable).

### Data analysis

Descriptive statistics primarily assessed patients' anxiety and depression before colonoscopy and their pain during and after the procedure. Relationships among study variables were obtained using Pearson correlations. The cut-off for statistical significance was  $p<0.05$ , whereas the effect size was appraised according to Cohen.<sup>57</sup> Three hierarchical multiple regression analyses were conducted to assess how different blocks of variables accounted for the variance in clinician-reported pain, patient-reported pain and PC. In each analysis, female gender, sedation score, age and colonoscopy experience were entered at Step 1 to control for spurious associations through these covariates. Procedure-related worry, anxiety and depression were entered at Step 2 to assess their unique associations with the pain variables. Last, emotional processing difficulties (Suppression, Unprocessed, Controllability, Avoidance and Emotional Experience) were entered at Step 3 to evaluate their incremental and unique contribution to predicting pain variables. Multicollinearity bias was assessed using the variance inflation factor (VIF) for each model predictor. The VIFs ranged from 1.01 for gender to 2.93 for suppression, values much below the most stringent threshold of 5, indicating extremely weak collinearity.

## RESULTS

**Table 1** reports the descriptive statistics assessed in the total sample. Regarding sedation, the Ramsay score ranged between 1 and 5, with 86.17% of the sample between 2 and 3, showing that most patients were awake, cooperative and responsive to commands during the procedure. A not negligible proportion of the patients (8.13%) were ostensibly agitated or restless (Ramsay score=1). Some patients (4.07%) were sleepy but vigorously responding to pain (Ramsay score=4), while 1.63% were sleepy but slowly responding to painful physical stimuli (Ramsay score=5). No patient was entirely unconscious or not arousable (Ramsay score=6). To attain an adequate level of sedation, the patients needed an average dose of 2.50 mg of midazolam ( $SD=0.98$  mg), 18.85 mg of meperidine ( $SD=24.33$  mg) and 14.88 mg of fentanyl ( $SD=22.95$  mg). No differences in drug doses were found between younger and older patients, and between first-timers and experienced patients accustomed to the procedure. Women required 0.52 mg more midazolam than men ( $t=-2.65$ ;  $df=121$ ;  $p=0.008$ ), but no difference

**Table 1** Sample's descriptive statistics

Variables	M	SD	Minimum	Maximum	Skewness	Kurtosis
1. Clinician rated pain	1.62	2.38	0	10	1.67	2.50
2. Patient-reported pain	0.00	1.00	-2	3	0.37	-0.23
3. Pain catastrophising	9.82	11.00	0	43	1.25	0.66
4. Procedure-related worry	20.53	8.60	8	40	0.59	-0.57
5. Anxiety	7.28	3.85	0	18	0.30	-0.20
6. Depression	4.24	2.84	0	13	0.90	0.53
7. Suppression	4.01	2.00	0	8	-0.07	-0.91
8. Unprocessed	3.80	1.98	0	8	-0.12	-0.69
9. Controllability	3.02	2.12	0	9	0.54	-0.37
10. Avoidance	4.51	2.11	0	9	-0.09	-0.71
11. Emotional experience	3.20	1.91	0	7	0.18	-0.94
12. Emotional processing	3.71	1.69	0	8	-0.06	-0.75
13. Age	57.70	15.00	22	88	-0.43	-0.29
14. Gender	52% (females)		1	2	-0.08	-2.03
15. Endoscopy experience	58% (experienced)		0	1	-0.32	-1.93
16. Ramsay Sedation Score	2.72	0.74	1	5	-0.47	1.53

Gender (1=male; 2=female); endoscopy experience (0=first timers; 1=experienced).  
N=123.

Avoidance, avoidance of emotional triggers; Controllability, failure to control emotional outbursts; Emotional Experience, impoverished emotional experience; Emotional Processing, emotional processing difficulties total score; Suppression, suppression of emotional experience and expression; Unprocessed, unprocessed emotions.

was found in meperidine or fentanyl doses. Controlling for BMI, sex differences remained statistically significant.

Notwithstanding sedation, the clinician rating of pain was above the cut-off value for probable pain for 34 patients (27.64%), and 12 patients (9.75%) were observed to be in moderate pain. The average level of anxiety was above the commonly used cut-off for fast screening of medical patients, and 55 patients (43.62%) exceeded that threshold. By contrast, the average depression level of the sample was much below the cut-off, and only 17 patients (13.82%) exceeded it.

**Table 2** reports the correlations among the study variables. Clinician-rated pain during colonoscopy was highly correlated with the patient's subsequent assessment of pain and PC. Procedure-related worry, anxiety and depression were positively intercorrelated. Surprisingly, none of these variables were linked to clinician-reported and patient-reported pain. However, anxiety and procedure-related worry were both positively correlated with catastrophising thoughts. Except for the unprocessed emotions scale, emotional processing difficulties assessed before endoscopy were associated with both clinician-reported and patient-reported pain and catastrophising thoughts. In particular, the tendency to avoid emotional triggers had the strongest correlation with the two pain measures. Difficulties in experiencing emotions and controlling emotional expression were the strongest predictors of catastrophising thoughts. All EP difficulties

were positively correlated with procedure-related worry, anxiety and depression.

The analysis of clinician-rated pain (**table 3a**) demonstrated that gender, age and colonoscopy experience did not contribute significantly to the regression model in Step 1. Only sedation score was negatively associated with pain, indicating that more sedated patients appeared less suffering to the doctor. Collectively, the set of predictors accounted for 26% of the variance. Introducing anxiety-related variables at Step 2, the model explained an additional 6% of the variance in clinician-rated pain, with procedure-related worry being the strongest positive predictor, so that more worried patients before colonoscopy were more in pain. Unexpectedly, depression was negatively associated with clinician-reported pain, indicating that the greater the patient's depression, the lower the patient's pain as rated by the doctor. Anticipating the discussion, this result appears to be a 'negative suppression effect', a statistical artefact that occurs when one of the predictors is more strongly associated with other predictors than with the criterion variable.<sup>58</sup> As seen in **table 2**, reporting zero-order correlations, this was the case for depression with procedure-related worry and anxiety. EP difficulties, entered at Step 3, collectively explained an additional 8% of the variance in clinician-rated pain. The final model accounted for 40% of the variance. Unlike zero-order correlations (**table 2**), avoidance was the only EP difficulty predicting clinician-rated pain, indicating

**Table 2** Correlations among study variables

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Clinician rated pain	—													
2. Patient-reported pain	0.60	***	—											
3. Pain catastrophising	0.62	***	0.80	***	—									
4. Procedure-related worry	0.15	0.18	0.31	***	—									
5. Anxiety	0.03	0.13	0.21	*	0.49	***	—							
6. Depression	-0.08	0.04	0.11	0.45	***	0.63	***	—						
7. Suppression	0.22	*	0.14	0.24	**	0.37	***	0.26	**	—				
8. Unprocessed	0.08	0.12	0.15	0.32	***	0.47	***	0.41	***	0.65	***	—		
9. Controllability	0.25	**	0.19	*	0.26	**	0.35	***	0.46	***	0.30	0.64	***	—
10. Avoidance	0.34	***	0.27	**	0.20	*	0.25	**	0.32	***	0.22	*	0.73	***
11. Emotional experience	0.22	*	0.21	*	0.19	*	0.42	***	0.40	***	0.31	***	0.69	***
12. Age	0.02	-0.22	*	-0.11	0.14	-0.04	0.12	0.22	*	0.06	0.16	0.18	*	—
13. Gender	0.15	0.10	0.18	*	0.16	0.19	*	0.07	-0.03	-0.07	0.03	0.05	-0.04	—
14. Endoscopy experience	0.04	0.05	0.10	0.10	-0.10	0.10	0.02	0.17	0.07	0.01	0.12	0.03	0.19	*
15. Ramsay Sedation Score	-0.48	***	-0.35	***	-0.25	**	0.01	0.00	-0.05	-0.08	0.03	-0.15	-0.12	-0.02
														-0.02

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001. Gender (1=male; 2=female); endoscopy experience (0=first timer; 1=experienced). N=123.

Avoidance, avoidance of emotional triggers; Controllability, failure to control emotional outbursts; Emotional Experience, impoverished emotional experience; Emotional Processing, emotional processing difficulties total score; Suppression, suppression of emotional experience and expression; Unprocessed, unprocessed emotions.

**Table 3** Summary of hierarchical regression analyses

	Step 1			Step 2			Step 3		
	B	Beta	t	B	Beta	t	B	Beta	t
<b>(a) Clinician-reported pain</b>									
Gender	0.74	0.16	1.96	0.61	0.13	1.61	0.70	0.15	1.88
Ramsay Sedation Score	-1.55	-0.48	-6.01***	-1.62	-0.50	-6.41***	-1.41	-0.44	-5.54***
Age	0.01	0.09	1.11	0.02	0.10	1.20	0.01	0.06	0.69
Colonoscopy experience	0.15	0.03	0.39	0.22	0.04	0.55	0.14	0.03	0.37
Procedure-related worry				0.06	0.21	2.24*	0.05	0.17	1.84
Anxiety				0.05	0.08	0.75	-0.02	-0.03	-0.22
Depression				-0.24	-0.28	-2.73**	-0.21	-0.25	-2.41*
Suppression							0.01	0.01	0.05
Unprocessed							-0.10	-0.08	-0.64
Controllability							0.14	0.13	1.18
Avoidance							0.33	0.30	2.52*
Emotional experience							-0.05	-0.04	-0.34
R <sup>2</sup> , F, p value	0.26	5.86	0.000	0.32	7.75	0.000	0.40	6.02	0.000
DR <sup>2</sup> , F, p value	0.26	10.18	0.000	0.06	3.60	0.016	0.08	2.75	0.022
<b>(b) Patient-reported pain</b>									
Gender	0.20	0.10	1.16	0.12	0.06	0.70	0.14	0.07	0.82
Ramsay Sedation Score	-0.43	-0.32	-3.73***	-0.44	-0.32	-3.82***	-0.39	-0.29	-3.28***
Age	-0.01	-0.19	-2.12*	-0.01	-0.21	-2.30*	-0.02	-0.25	-2.67**
Colonoscopy experience	0.18	0.09	1.02	0.22	0.11	1.21	0.20	0.10	1.13
Procedure-related worry				0.03	0.22	2.18*	0.02	0.18	1.72
Anxiety				0.01	0.05	0.40	0.00	-0.01	-0.04
Depression				-0.03	-0.09	-0.80	-0.03	-0.07	-0.65
Suppression							-0.05	-0.10	-0.70
Unprocessed							-0.01	-0.02	-0.17
Controllability							-0.02	-0.04	-0.32
Avoidance							0.13	0.28	2.14*
Emotional experience							0.05	0.09	0.65
R <sup>2</sup> , F, p value	0.17	5.86	0.000	0.21	4.35	0.000	0.26	3.27	0.000
DR <sup>2</sup> , F, p values	0.17	5.86	0.000	0.04	2.12	0.102	0.05	1.60	0.166
<b>(c) Pain catastrophising</b>									
Gender	4.08	0.19	2.13*	2.80	0.13	1.49	3.09	0.14	1.59
Ramsay Sedation Score	-3.31	-0.22	-2.54*	-3.37	-0.23	-2.69**	-3.01	-0.20	-2.27*
Age	-0.07	-0.10	-1.08	-0.10	-0.14	-1.53	-0.10	-0.14	-1.50
Colonoscopy experience	3.03	0.14	1.53	3.68	0.17	1.90	3.61	0.16	1.82

Continued

Table 3 Continued

	Step 1		Step 2		Step 3	
	B	t	B	t	B	t
Procedure-related worry			0.42	3.25**	0.39	2.89**
Anxiety			0.16	0.47	0.00	-0.01
Depression			-0.32	-0.74	-0.29	-0.64
Suppression					-0.16	-0.21
Unprocessed					0.05	0.07
Controllability					0.50	0.79
Avoidance					0.57	0.82
Emotional experience					-0.19	-0.23
R <sup>2</sup> , F, p value	0.11	0.000	0.22	0.000	0.23	0.000
DR <sup>2</sup> , F, p value	0.11	0.006	0.10	0.003	0.02	0.805

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001. Gender (1=male; 2=female); endoscopy experience (0=first time colonoscopy; 1=previous colonoscopy). Avoidance, avoidance of emotional triggers; Controllability, failure to control emotional outbursts; Emotional Experience, impoverished emotional experience; N, 123; Suppression, suppression of emotional experience and expression; Unprocessed, unprocessed emotions.

that patients who avoided emotional triggers the week before endoscopy were rated as more in pain during the procedure.

The analysis of patient-reported pain revealed that sedation score and age contributed significantly to the regression model. Older and more sedated patients reported less pain after the procedure. Step 1 variables collectively accounted for 17% of the variance (table 3b). At Step 2, the procedure-related worry was the only significant predictor among anxiety-related variables, indicating that greater worry before colonoscopy anticipated greater perceived colonoscopy pain after the procedure. Overall, the predictors entered at Step 2 added 4% of explained variance, but the incremental R<sup>2</sup> for the entire block was not significant. At Step 3, avoidance of emotional triggers was the only EP difficulty predicting pain significantly. In all, EP difficulties combined added an extra 5% of explained variance, but the increment was not significant. The final model, however, accounted for 26% of the variance.

The PC analysis demonstrated that Step 1 variables accounted for 11% of the variance, with women reporting more negative cognitive-affective responses during colonoscopy (table 3c). In Step 2, anxiety-related variables added 10% of the variance in pain. As in previous analyses, procedure-related worry before endoscopy predicted more catastrophising thoughts and made the gender effect no longer significant. At Step 3, none of the emotional processing difficulties increased the amount of significant variance accounted for by the model, which, however, explained 23% of the variance in catastrophising thoughts. In sum, regression analyses showed that avoidance made a unique contribution to predicting all study outcomes, supporting the research hypothesis that EP difficulties predict colonoscopy pain, controlling for patient characteristics and anxiety-related variables.

## DISCUSSION

Although colonoscopy is performed under conscious sedation, pain cannot be eliminated,<sup>15–17</sup> and the procedure is shrouded in fear and anxiety.<sup>4–6 12</sup> Confirming this, about one-fourth of the patients in our research were above the probable pain threshold, and a not-negligible number were likely suffering from moderate pain. The prevalence of anxiety was also relatively high for a non-psychiatric sample, with about half of the patients exceeding the conventional cut-offs used to screen medical populations. From a psychological point of view, fear, anxiety and pain are thought to be exacerbated by difficulties in spontaneously adapting to emotional events to reduce their psychological and physiological burden.<sup>32–36</sup> For example, EP difficulties worsened pain intensity in several chronic syndromes.<sup>34 36 47</sup> No study so far has applied EP concepts to colonoscopy pain and, more generally, to pain deriving from an aversive medical procedure. Our study adds to the literature because EP difficulties accounted for significant variance in procedure pain and associated



catastrophising thoughts. Indeed, we discovered that failing to control emotions, having a poor emotional experience and avoiding emotional triggers before the procedure were all associated with poor pain outcomes during and after colonoscopy and higher procedure-related worry and anxiety.

Failure to control emotions refers to the experience of intense negative feelings with a low degree of control over their behavioural expression.<sup>36</sup> Colonoscopy patients who reported controllability issues may have had a more unpleasant experience because they not only magnified their worries and fears but also responded more forcefully to emotional discomfort, perhaps interfering with the procedure. Indeed, colonoscopy pain can be due to abrupt manoeuvres by the endoscopist in response to voluntary or involuntary patient behaviours.

An impoverished emotional experience corresponds to a deficit in emotional awareness.<sup>36</sup> Plenty of literature links this deficit to increased pain sensitivity and severity through increased anxiety and hypervigilance.<sup>39–40</sup> Accordingly, colonoscopy patients lacking emotional awareness might have experienced greater anxiety, which in turn increased their attention to bodily sensations, confounding them with or adding to procedural pain. The same literature<sup>40</sup> also suggests an alternative account: physiological hyperarousal associated with poor emotional awareness might have produced pain-inducing alterations in the bowels. For example, a recent study of irritable bowel syndrome<sup>59</sup> found a positive correlation between impoverished emotional experience and abdominal pain.

Unlike controllability and emotional experience, avoidance of emotional triggers uniquely contributed to predicting pain outcomes in regression analyses. Therefore, our study suggests that avoidance may be a focal factor in the onset of colonoscopy pain in patients who fear the procedure. How is avoidance different from other EP difficulties? What is implied by its unique contribution to pain prediction? In the emotional processing model,<sup>35–37</sup> avoidance is thought to impede the emotional input at a very initial stage preventing the surge of an emotional experience and the behavioural expression of emotions.<sup>35–37</sup> Hence, if a person avoids encountering the feared event (eg, diverting attention from the upcoming colonoscopy), the emotional processing of that event cannot be completed, and any emotional experience issues or difficulties in controlling the expression of emotions may not even manifest. This ensures a benefit to patients (eg, not being overwhelmed by worries or concerns),<sup>60</sup> but their fears do not soothe or extinguish spontaneously.<sup>32–33</sup> According to this stance, avoidant patients may have disregarded or diverted their attention to the procedure days before the examination. However, when these same patients confronted the situation they feared on endoscopy day, they could not escape it, and, because they were unprepared, became highly anxious and fearful. Negative emotions vehemently burst into the patient's mind,

increasing catastrophic thoughts and making the colonoscopy experience more painful.<sup>24</sup>

Previous research on patients undergoing aversive medical procedures has focused on procedural anxiety and catastrophising thoughts.<sup>28–30</sup> Our study also controlled for procedure-related worry and anxiety in predicting situational PC and pain outcomes. Regarding pain, the effect size of anxiety-related variables was not sufficiently large to attain statistical significance in regression analyses. However, both variables predicted the patients' situational PC, which was also strongly associated with the clinician and patient ratings of pain. These findings are in keeping with previous research<sup>27</sup> and support our preliminary findings,<sup>61</sup> suggesting that procedural anxiety might evolve into pain when patients feel they could not cope with the negative emotions elicited by endoscopy and when they catastrophise about unpleasant physical sensations. This conclusion could be strengthened by an experimental study in which patients' abilities to cope with negative emotions associated with colonoscopy are improved.

Identifying which patients might tolerate endoscopy less well is challenging.<sup>18–19</sup> Pain during colonoscopy has been linked to female gender and younger age.<sup>20–22</sup> Previous research with EGD patients also demonstrated that experience with endoscopy could mitigate anxiety and pain.<sup>61</sup> These variables were only of minimal importance in the present study. In bivariate analyses, younger age and female gender were associated with more pain, but these relationships were marginally or not significant in regression analyses. This finding underscores the need for targeting specific patients who might tolerate colonoscopy less well based on a preliminary psychological screening, not simply considering whether the patient belongs to a demographic group. For instance, PC (a variable associated with female gender and pain outcomes in our study) was found to be modifiable through psychological preparation for surgery patients.<sup>31</sup> Such intervention should be directed at colonoscopy patients with high levels of catastrophic thinking. Indeed, procedure-related worry and anxiety can be defused through positive appraisals of the medical examination and its results.<sup>62</sup> At the same time, psychological preparation might be unnecessary for calm and relaxed patients and those with no emotional processing difficulties.

Returning to the relationship between processing emotions and colonoscopy pain, it is worth noting that our findings went beyond mere correlational evidence and were robust to confounding factors like differences in sedation effectiveness among patients and having previous colonoscopy experience. Moreover, our conclusions are not solely based on self-report. All medical team members were blinded to the patient's responses to psychological scales, and the medical doctor who rated the patient was trained to observe the patient's behaviour during the procedure using a well-established procedure.<sup>54</sup> Therefore, the finding that avoidance was the single best psychological predictor of pain was particularly

robust to self-report bias, as shown by the regression analysis with clinician-rated pain as the criterion variable.

Regarding the size of the effects of EP variables tested in regression analyses, reducing patient avoidance by one standard deviation (ie, about two units in the corresponding EPS score) would result in a colonoscopy pain reduction equal to one-third of a SD in clinician-rated pain (ie, about 1 unit in the PAINAD score). Simply put, if patients had been prepared for colonoscopy with an emotion-oriented intervention of this size, we would have gotten an estimated reduction of 7 (ie, 22%) and 3 (ie, 7%) patients above the cut-off value for probable and moderate pain, respectively. Although this result may seem modest, one must consider that the effect size obtained in the multiple regression for avoidance reflected what this predictor added to the explained variance in colonoscopy pain adjusted for other EP difficulties and confounding factors. Therefore, it is a conservative estimate of how avoidance shaped the patient experience and affected pain above and beyond other predictors.

Avoidance, and EP difficulties, can be successfully addressed using psychotherapy.<sup>37</sup> However, this clinical approach is not feasible in the endoscopy suite or the moments immediately preceding colonoscopy. Yet, suppose avoidance is maintained for several days before the colonoscopy. In that case, the cognitive structure of the patient cannot be challenged or modified, and with it, the hoped extinction of fear does not occur.<sup>41 42</sup> Therefore, a brief psychological preparation addressing avoidance should be implemented considering the possibility of confronting patients with the feared procedure. For example, psychologists and doctors could schedule a collaborative counselling session in which the patient is given the opportunity to 'visualise' the endoscopy situation, potentially disclosing his/her worries. A clinical trial going in this direction would test the viability of this approach and establish causal links between avoidance, procedure-related worries and pain.

Before concluding, it is worth acknowledging certain limitations of our study. First, we noted some inconsistencies and suppression effects across the three multiple regression analyses. For instance, procedure-related worry only predicted PC, but not the pain outcomes (Step 2 in multiple regression), or depression scores were negatively associated with clinician-reported pain. We believe inconsistencies could be due to the interactions among the study variables in multivariate analyses and the study design. Suppression effects occur when the predictors are more correlated with each other than with the dependent variable.<sup>58</sup> Our study also found this because depression was more strongly associated with procedure-related worry and anxiety than with pain outcomes. Methodological factors might have increased the likelihood of detecting suppression effects. For instance, our study used a prospective design, which could have inflated predictor–predictor correlations assessed at a specific time point while at the same time deflating the predictor–outcome correlations assessed at different

time points. Moreover, we used a multimodal assessment of pain, such that depression was more strongly associated with other patient-reported outcomes than clinician-rated ones. These features, however, strengthened the study's internal validity, allowing the determination of truly predictive relationships and control over bias in pain assessment using only a single assessment.

A second limitation was that sedation might have biased the patient's memory of pain. For instance, midazolam caused transient anterograde amnesia in endoscopy patients, who were asked to recall information provided to them before sedation.<sup>63</sup> Similarly, self-reported pain ratings collected from patients after colonoscopy could have been biased by the psychotropic drugs used. In addition, under-reporting and social desirability might also be present in self-reported pain. However, our study showed a considerable agreement ( $r=0.60$ ) between self-reported pain and pain assessed by physicians, evaluated independently at different time points. Although this finding does not entirely rule out potential biases in self-reported pain, it supports our belief that this bias could not entirely invalidate the conclusions of the present study. Future research could use a memory probe<sup>64</sup> and a social desirability scale and use them as a covariate in data analysis or exclude patients with temporary amnesia.

A third limitation is that only one doctor rated the patient during endoscopy due to organisational constraints. Although we used a structured observational scale with established evidence of inter-rater reliability,<sup>65</sup> the study's design prevented us from reassessing it and ruling out potential biases in pain rating. However, it must be said that inter-rater reliability does not need to be assessed in every application of the scale. For instance, several recent studies, both clinical trials and observational, have used only one rater.<sup>66 67</sup> All raters were thoroughly trained and supervised in these studies to ensure consistency and reproducibility of assessment procedures, as we did in our research.

Notwithstanding limitations, our study is the first to address how difficulties in emotional processing and PC shaped the patient's colonoscopy experience. Indeed, early identification of dysfunctional emotional processing styles associated with PC can help define personalised preparation paths<sup>31</sup> to decrease the level of PC and address EP difficulties in patients who fear pain during colonoscopy. Moreover, our findings may set the stage for future clinical trials to improve the patient experience with colonoscopy and the quality of endoscopy.<sup>13</sup>

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