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INTERVENTIONAL PAIN & SPINE MEDICINE SECTION

Patient Expectancy Does Not Predict Success or Failure of Thermal Neurotomy for Persistent Zygapophysial and Sacroiliac Joint Pain

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Abstract

Objective. The placebo effect is important in determining the outcome of the treatment of pain for which expectancy and context are the main contributors. The variable success of thermal neurotomy spinal pain procedures is often seen as evidence of the placebo effect. Conversely, proponents of pain procedures explain poorer outcomes by technical procedure deficiencies, including inadequate diagnosis. This cohort study set out to determine whether patient expectancy is a contributing factor in the outcome of thermal neurotomy to the cervical, thoracic, and lumbar zygapophysial and sacroiliac joints. **Design**. This single-practitioner, single-site retrospective analysis of prospectively gathered cohort data of 549 patients evaluated the impact of patient preprocedure expectancy (rated on a simple 0–10 or 0–4 numerical rating scale) on outcomes in a large consecutive series of patients who had undergone thermal neurotomy treatment between 2009 and 2019. In addition, a portion of patients were asked to what extent they hoped for or desired a good outcome. **Results**. Successful pain relief (≥75% reduction from baseline) was not associated with a higher preprocedure expectancy than were failed procedures. Hope and desire demonstrated no impact on the positive or negative impact of the procedure. **Conclusions**. Altogether, patient expectation of outcome, hope, and desire are not associated with the outcome of effective pain relief by thermal neurotomy that has been performed to the appropriate and commonly available technical standards. Further work is needed to determine the influence of patient expectation across a range of pain intervention modalities.

Key Words: Thermal Neurotomy; Expectancy; Placebo Response; Outcomes

Introduction

Pain intervention procedures sometimes deliver less than the expected relief and sometimes deliver no relief for the patient. This can be ascribed in part to extrinsic factors, such as diagnostic inadequacy leading up to the procedure and technical issues related to the performance of the procedure against accepted best practice [1]. Relatively high treatment success rates are often attributed to patient expectations, i.e., a placebo response rather than an interventional neurophysiological effect [2], representing the inherent influence of the context on any treatment of any pain [3].

As reported by Bingel et al., "for analgesic treatments, up to 50% of the treatment response can be attributed to expectation and not to the pharmacodynamic effect of the administered drug," and as further reported, "positive expectations predict outcomes in multimodal treatment programs for chronic pain and surgical approaches" [3].

On this basis, it would be reasonable to predict that expectancy also contributes to the success of invasive interventions for persistent pain, such as the commonly performed thermal neurotomy of painful zygapophysial and sacroiliac joints. The exploration of patient expectation of pain relief outcomes in interventional procedures is still in its infancy [4–6]. It is argued that the placebo effect is defined by the expectation of a treatment benefit

playing some role in the observed treatment benefit [7] as compared with no treatment [8].

A recent systematic review comparing selected minimally invasive musculoskeletal, neurological, and cardiac procedures with placebo sham procedures concluded that the generally small differences in effect sizes between active treatment and sham suggest that nonspecific mechanisms, including placebo, not directly related to the pathophysiology are major predictors of the observed effects [9].

However, to truly exclude a placebo effect, then the procedure itself must carry high true positive (positive predictive value) and low false negative (high specificity) diagnostic and therapeutic proficiencies. Any less, then any "failure" of the procedure, and conversely any "success," automatically allows for the heightened possibilities of the outcome being influenced by false negative and false positive attributes, including expectancy. A positive therapeutic outcome in that context naturally allows for considerations of placebo effects, such as a patient's expectancy, hope, and desire, as explanatory "causes" of the success. Although the clinical outcome in either scenario may be enhanced by the expectancy effect, it denigrates the technicalities of the procedure if one imputes the outcome solely to such effects. Conversely, if a "technically implausible" procedure provides a positive outcome, the likelihood that a placebo response was involved is enhanced, given that the procedure itself could not have targeted the putative pathophysiological mechanisms on which it is based. The recent systematic reviews of cervical and lumbar thermal neurotomy demonstrate that the outcomes are proportional to the technical scientific correctness of the techniques used [10]. Indeed, the systematic review of Schneider et al. suggested that the whole future of neurotomy was founded, and may have foundered, on a then-unrecognized technical fallacy that the proximity of the thermal lesion to the target nerve was not essential to the success of the procedure [11].

There is now a commonly held view, developed from numerous experimental and clinical studies, that the placebo response is generated by patient expectancy of outcome [4, 12]. *Expectancy*, a patient's expectation, in this context is defined as "the human subjective correlate of 'prediction', a central nervous system process that estimates the probability and value (utility) of future outcomes and the potential costs of actions required to approach or avoid them" [13]. Expectancy is shaped by a patient's previous experiences, conditioning, learning, and observations that inform the patient as to the likelihood of an outcome or response [12]. Thus, it can be conceptualized that the context of a procedure, including previous positive experiences, physical location, administrative and financial processes, the consent process, staffing attitudes, and the procedure environment, can influence the patient, leading to an enhanced expectation of some effect. Patients' expectancy, their "confidence in their likely experience of an outcome" [14], is enhanced by verbal instruction and by conditioning that would have developed through their processing of positive responses to previous procedures, whether for diagnostic or therapeutic purposes [15]. Therefore, patient expectancy is influenced not only by the doctor–patient encounter but also more broadly by the wider patient–health care system encounter [16].

As differences in procedures, staff, and centers can influence patient expectation, the present study examines retrospectively by prospectively gathered data a decade-long cohort of patients who were exposed to the same practitioner and the same environment, were provided uniform information relevant to their index intervention, and were followed up the same way by the same clinic staff. The aim of the study was to determine whether a successful procedure was associated with greater patient expectation than that associated with a failed procedure, and conversely whether the preprocedure expectation predicted the outcome. If these showed positive associations, then the clinical implications of amplifying patient expectations are enhanced. If there is no association of expectancy with a successful outcome, then it adds weight to the evidence that successful thermal neurotomy is based on the underlying peripheral target neuroanatomy and disease processes and not generated by patient expectation.

Methods

Patient records were retrospectively analyzed for prospective data gathered from 2009 to 2019 from patients with persistent pain who had undergone thermal radiofrequency (RF) treatment with a single private practitioner, after the appropriate diagnostic process and according to the published standards of the Spine Intervention Society, in a community-based nonacademic clinic in a provincial city in Australia. As part of the routine consent process, patients are informed that one of the goals of the treatment is 6 to 18 months of good relief, which then allows for improvement in physical and psychological function. Patients who had less than 80% relief with the diagnostic workup would be informed of a lower likelihood of good pain relief. Thus, a positive context or expectancy is naturally created, as would be the case in most if not all interventional procedures or operations for any condition.

Assessment of Expectancy

Between 2009 and 2019, patients were given a questionnaire to complete, unsupervised, in the waiting room immediately before their neurotomy procedures. The questionnaire assessed their index pain on a 0–10 numerical rating scale (NRS). They were not provided any explanation of terms such as *expectancy*, *hope*, or *desire*.

To measure expectancy, patients were asked to rate "How much do you expect this procedure to help the

target pain?"on a NRS in a single-statement expectancy questionnaire. From 2009 to 2014, this was scaled from 0 to 10, where the verbal anchors were "0 = expect no relief," "neutral over the midpoint," and "10 = expect full relief." The same format was used to assess their hope and desire. In 2014, after observation that the 0–10 scale resulted in responses that appeared tightly skewed to 9 and 10, the scale was shortened to 0–4 in an attempt to generate a more meaningful spread.

Data collected from patients for the purpose of this study included age, gender, duration of pain, interventional treatment, average pretreatment and 3-month posttreatment pain scores (NRS pain scale 0–10; without specific investigation as to whether the target pain was being scored), and baseline expectancy, hope, and desire scores. For the purposes of this study, treatment success was defined as ≥75% pain relief from baseline measured at 3 months after the procedure (by which time the treatment is likely to be showing its best effect) and treatment failure as ≤30% improvement in pain on the NRS. These two disparate groups were selected in order to create a clear distinction between treatment success and failure for purposes of gleaning any contribution to outcome from patient expectancy, hope, or desire. Patients with 31–74% pain relief were excluded from the expectancy, hope, and desire analyses.

Statistical Analysis

The baseline characteristics of the patients were described as means with standard deviations. The association of the lowest vs the highest quartile of patients' expectations for successful pain relief (i.e., subjective improvement from baseline at the 3-month [or last observation carried forward] visit) was analyzed with descriptive statistics. Likewise, conversely, whether the treatment success or failure was predictively associated with preprocedure patient expectancy was compared. Analysis of the total groups, as well as of the subgroups by region of cervical, thoracic, lumbar, and sacroiliac joints, grouped into 0–10 and 0–4 scales, was undertaken with descriptive statistics as well as regression analysis.

Results

Between 2009 and 2019, there were 549 RF procedures performed by the practitioner with complete data sets for this study. Of the expectancy questionnaires, a total of 276 questionnaires using a 0–10 expectancy NRS (2009–2014) and 273 questionnaires using a 0–4 expectancy NRS (2014–2019) were analyzed.

Baseline Characteristics

Baseline demographics and clinical characteristics of the patients included in the analysis are shown in Table 1. The mean age at the time of the procedure was 60 years in both cohorts, with 44–46% of patients being female. At baseline, the mean NRS pain score was 6.7 ± 1.9 in the 0–10 group and 6.5 ± 2.1 in the 0–4 group. The duration of pain among patients varied, with a mean duration of pain of 108.5 ± 104.8 months in the 0–10 expectancy NRS group and 145.1 ± 147.7 months in the 0–4 expectancy NRS group. Across the regions, baseline pain was similar, with the exception of the sacroiliac region being higher in patients assessed with the 0–10 expectancy NRS.

Pain Relief

For the purposes of this study, intervention success was defined as ≥75% reduction in pain at 3 months after the procedure compared with baseline, as measured by NRS scores. Figure 1 shows the patient-reported pain relief at the 3-month postprocedural questionnaire follow-up without verbal verification or cross-checking that pain scores were for the target area of that procedure. Across the interventions, 20.4% of patients in the 0–10 NRS group and 17.8% in the 0–4 NRS group had successful pain relief (≥75% reduction vs baseline).

Expectancy, Hope, and Desire

In general, at baseline, patients had high expectancy of pain relief with their RF procedure, with the average expectancy scores being well above the midpoint for both scales (Table 1). Across all procedures, the average expectancy scores were 8.1 ± 2.1 and 3.3 ± 0.7 on the NRS 0–10 and NRS 0–4 questionnaires, respectively. The same 0–10 NRS was used to measure hope and desire across the groups and showed that both hope and desire were lower than expectancy scores (Table 1).

Patient expectancy scores and pain relief outcome were assessed for association in terms of the success of the intervention at 3 months after treatment in three ways. A regression analysis of expectancy predicting pain relief in the 0–4 and 0–10 cohorts overall is shown in Figure 2. In patients using the 0–4 NRS, expectancy accounted for only 2% of the variation in pain relief ($r^2 = 0.02$, $F = 5.15$, $P = 0.02$). In patients using the 0–10 NRS, expectancy was not associated with pain relief at all ($r^2 = 0.0009$, $F = 0.25$, $P = 0.62$).

To take the analysis further, we explored the association of expectancy to pain relief, stratified by pain relief. A regression analysis of expectancy in patients who reported ≤30% pain relief and ≥75% pain relief is shown in Figure 3. Expectancy was not associated with pain relief at all in either of the 0–4 NRS ($r^2 = 0.02$, $F = 3.21$, $P = 0.08$) or 0–10 NRS ($r^2 = 0.02$, $F = 3.55$, $P = 0.06$) groups. An analysis of means is shown in Table 2. Overall, patients using the 0–10 expectancy NRS who reported ≥75% pain relief did not have significantly higher expectancy scores associated with pain relief success than did those who reported ≤30% pain relief. However, in patients using the 0–4 NRS, the mean expectancy score for patients who reported ≥75% pain

Table 1. Baseline demographics and scores of expectancy, hope, and desire at the preprocedure point

Characteristic	0–10 Expectancy NRS (n = 276)	0–4 Expectancy NRS (n = 273)
Female, n (%)	164 (44.4)	161 (46.0)
Male, n	189	205
Mean age, years ± SD	60.1 ± 14.9	60.4 ± 15.6
Mean duration of pain, months ± SD	108.5 ± 104.8	145.1 ± 147.7
Baseline pain, mean NRS ± SD	6.7 ± 1.9	6.5 ± 2.1
Cervical	6.7 ± 1.7	6.2 ± 2.2
Thoracic	6.7 ± 1.9	6.7 ± 1.5
Lumbar	6.6 ± 2.0	6.6 ± 1.8
Sacroiliac	6.8 ± 2.1	6.6 ± 2.6
Expectancy, mean NRS ± SD	8.1 ± 2.1	3.3 ± 0.7
Cervical	8.0 ± 2.1	3.4 ± 0.6
Thoracic	8.9 ± 0.8	3.3 ± 0.7
Lumbar	8.1 ± 2.0	3.2 ± 0.7
Sacroiliac	7.6 ± 2.8	3.3 ± 1.0
Hope, mean NRS ± SD	6.8 ± 3.0	6.3 ± 3.1
Cervical	6.9 ± 2.9	6.3 ± 3.0
Thoracic	8.9 ± 2.0	6.4 ± 3.1
Lumbar	6.5 ± 2.9	6.6 ± 3.0
Sacroiliac	6.9 ± 3.5	5.6 ± 3.2
Desire, mean NRS ± SD	7.0 ± 3.0	6.5 ± 3.0
Cervical	7.3 ± 2.9	6.8 ± 3.0
Thoracic	9.1 ± 2.0	6.4 ± 3.0
Lumbar	6.7 ± 3.0	6.8 ± 2.9
Sacroiliac	7.0 ± 3.5	5.3 ± 2.8

SD=standard deviation.
When the expectancy scale was changed from 0–10 to 0–4, the hope and desire NRS scales remained at 0–10.

relief compared with ≤30% pain relief reached statistical significance (mean expectancy score of 3.4 ± 0.6 vs 3.2 ± 0.7; $P = 0.05$) but those scores are not of meaningful clinical difference. In addition, when expectancy scores were examined according to treatment region, there were no significant differences in the mean expectancy scores for any treatment success subgroups compared with the respective matched ≤30% pain relief subgroups. Figure 4 shows the dichotomous charts for pain relief and expectancy. The odds ratio was calculated by classifying an expectancy of 3 or 4 as "high" on the 0–4 NRS and an expectancy of 8, 9, or 10 as "high" on the 0–10 NRS. In a comparison of expectancy related to outcome success or failure based on our predefined cut-offs of ≥75% and ≤30%, the odds ratios were 0.575 for the 0–4 cohort and 0.435 for the 0–10 cohort. Furthermore, there were also no significant differences in the mean hope or desire scores across any region based on pain relief or success (Table 3). Examination of the distribution of scores in patients using the 0–10 NRS compared with those using the 0–4 NRS showed that shortening the scale did not spread the expectancy scores in a meaningful way (Figure 5). Overall, among patients using the 0–10 NRS, 85.2% selected 7, 8, 9, or 10, while among patients using the 0–4 NRS, 89.0% selected 3 or 4.

Discussion

This is the first large, single-investigator case series examining the effect of patient expectancy on procedure success or failure in a pain intervention procedure—in this series, thermal RF. Unlike multi-investigator studies, the structure of this study unifies the components of the doctor–patient encounter across all patients. It thereby neutralizes enhancement of placebo or nocebo, as all patients were exposed to the same practitioner in the same environment, were provided uniform information relevant to their index intervention, and were followed up the same way by the same clinic staff in the context of pain interventional procedures.

We analyzed patient expectancy, hope, and desire of treatment success immediately before 549 RF procedures across two rating scales. Although there was a statistically significant difference in the mean expectancy scores overall for the 0–4 NRS, regression analysis determined this influence to be minimal (2%), and we expect that the clinical relevance of this finding is questionable. Furthermore, the odds ratio demonstrates that from a categorical perspective, expectancy was not associated with success or failure. If patients assume only whole numbers may be selected, the mean scores of 3.2 and 3.4 found to be statistically different in this study would be difficult to distinguish in practice. Both values are above the midpoint in the scale and suggest that patients selecting these values expected the procedure to be more likely successful than unsuccessful. Amending the scale to contain additional values may not be useful, as the analysis of the 0–10 NRS failed to detect an association between pre-intervention expectancy and pain relief.

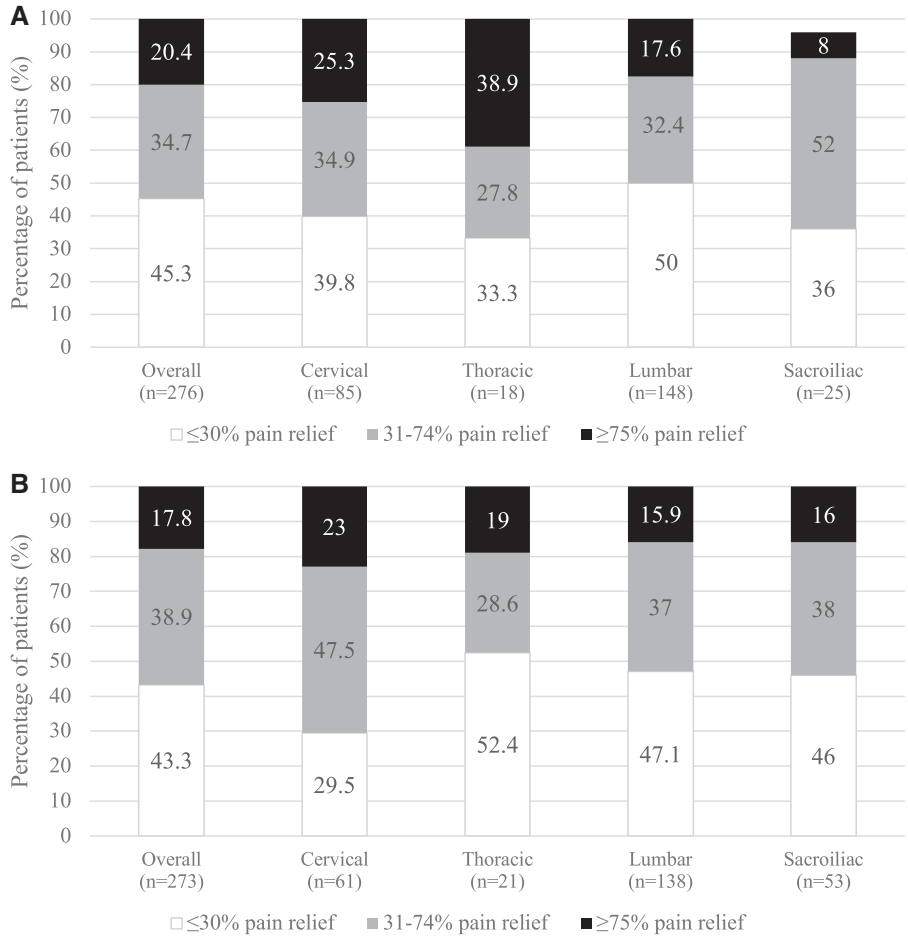

Figure 1. Proportions of patients by pain relief outcome reported at the 3-month follow-up in patients who completed **(A)** the expectancy NRS 0–10 questionnaire and **(B)** the expectancy NRS 0–4 questionnaire.

Furthermore, hope and desire assessed on a 0–10 NRS scale also failed to show a statistically significant association with pain relief across any cohort. Therefore, though just meeting the criteria for statistical significance on the basis of the mean expectancy score, in practice, the results suggest that expectancy is unlikely to be a driver of pain relief success when procedures are performed to the highest standard in the cervical, thoracic, lumbar, and sacroiliac regions.

The notion of the placebo effect attributes some portion of the subjective improvement of symptoms, especially in cases where a treatment's mode of action or efficaciousness is not clearly defined, to something other than the intervention itself [12]. When it comes to procedures such as RF, it is possible that there are multiple factors influencing the intervention's outcome, including the patient, the clinician, and the environment [17]. Given the evidence showing that the placebo response is inherently context specific, the present study minimizes variance that may develop from potential confounders, such as the variable influence of varying clinicians and varying therapeutic milieux and environments, through the use of a single investigator in a uniform clinical milieu and environment.

Finding no significant uniform association between high or low expectancy and pain outcome adds to the evidence that the technical pathophysiological and anatomic aspects of the procedure itself, rather than a placebo or nocebo effect, are the dominant drivers of the outcome. Our finding also supports a reconsideration of the increasing discussion in the literature that central neuroplastic changes in persistent pain create the pain relief response, as the present results show that any neuroplastic changes that this large number of patients would have developed were readily rendered inconsequential in the face of a successful procedure. Neither the patients' preprocedure expectancy nor pain intensity played any role in the outcome, whether successful or unsuccessful.

Other groups have critiqued patient expectancy studies and have suggested that limitations or biases are not limited to the doctor–patient interaction or environment [17]. A systematic review of patients with low back pain reported that expectancy as a predictor of outcomes was strongest when based on specific short-term time frames and outcomes [18]. In the present study, expectancy was measured as a single question without a specified time frame. In contrast to the study by Finniss et al. that aimed to study "the determinants of placebo effects in chronic

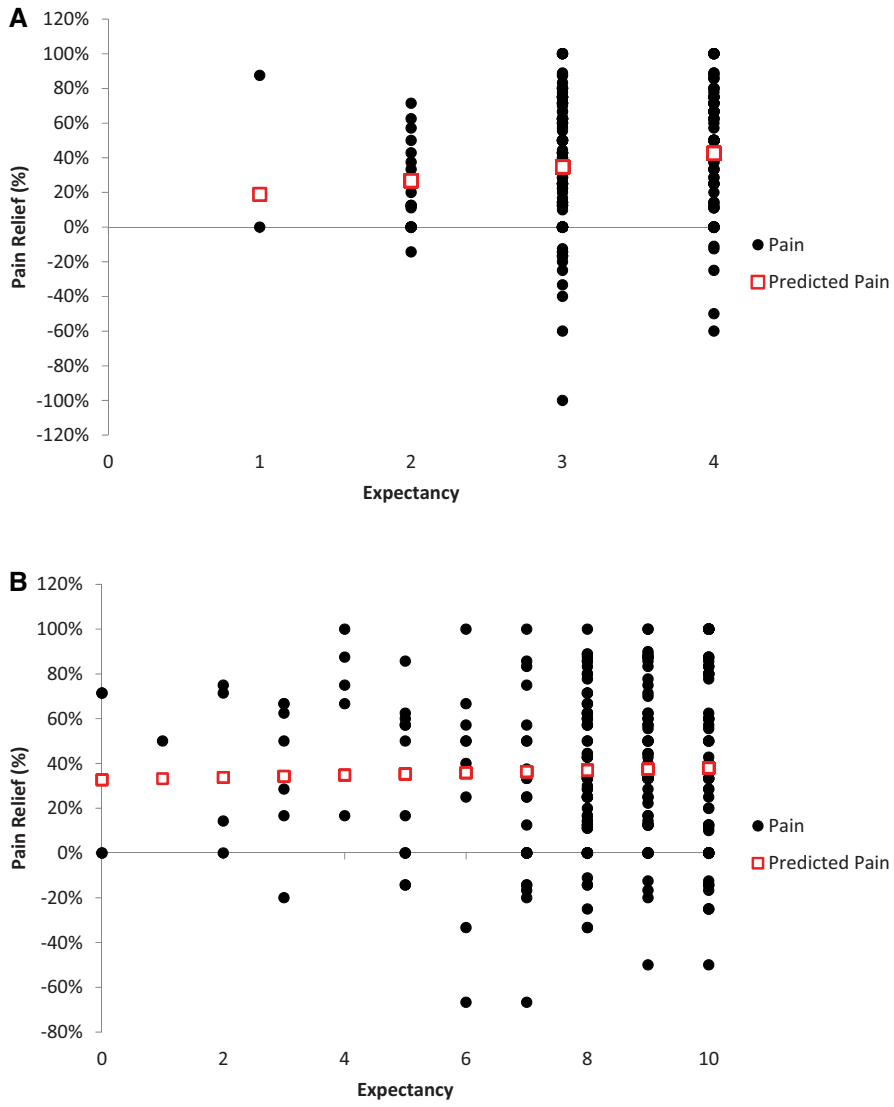

Figure 2. Regression analysis of expectancy and pain relief in **(A)** the total 0–4 cohort and **(B)** the total 0–10 cohort.

low back pain" and measured "percentage reduction in pain expected after injection," the present study has measured patient expectancy of relief without specifying it quantitatively. Thus, this study is not conflating ideas of success with how much relief is expected but rather is simply asking whether relief is expected without requiring a specified amount of relief to be regarded as successful by the patient. Moreover, as the success or failure of relief at 3 months after the neurotomy was independent of expectancy, this study suggests that any heightened patient expectation has no bearing on maintenance of relief, at least of this duration and after two positive diagnostic procedures.

As reported in Cormier et al. in 2016, patients' pretreatment expectations predict numerous health outcomes and are considered important in placebo analgesia, having a significant impact on treatment response [19]. Their study showed the relevance of patient expectations as they pertained to outcomes from a multidisciplinary pain program, where interventions addressed a range of psychological, social, and physical domains. However, the present study lends weight to the contrary view that perhaps no amount of positive or negative expectancy overrides a correctly provided treatment for a correctly derived diagnosis, at least with regard to painful zygapophysial and sacroiliac joints. It could be reasonably expected that a combination of these two approaches—namely, a multidisciplinary program and thermal neurotomy—may multiply the benefits. However, it could also be argued that successful neurotomy, where relevant, would obviate the need for such a complex and resource-laden program for an individual with a double-block positive diagnosis, with positive benefits for the use of health resources.

It is understood that patient expectancy is influenced both positively and negatively by a number of biopsychosocial factors, including gender, educational level, age, race, psychological factors, perception of pain tolerance, and even marital status [17]. In the present study, the effect of gender,

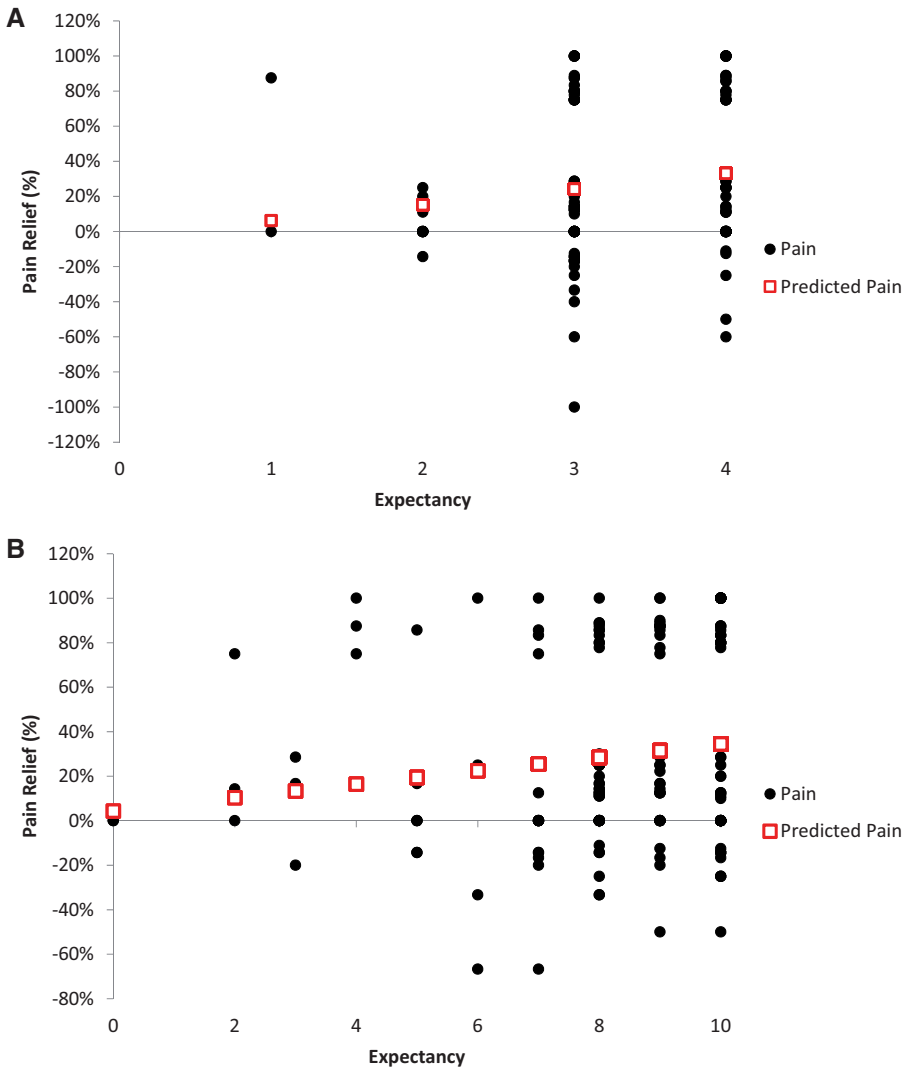

Figure 3. Regression analysis of expectancy and pain relief in **(A)** patients who reported ≤30% pain relief (failure) and ≥75% pain relief (success) in the 0–4 cohort and **(B)** patients who reported ≤30% pain relief (failure) and ≥75% pain relief (success) in the 0–10 cohort.

Table 2. Comparison of patient expectancy score by pain relief at 3 months after the intervention

	<30% Pain Relief	≥75% Pain Relief	
	Mean ± SD (n)		*P* Value*
Overall			
Expectancy NRS 0–10	8.0 ± 2.1 (124)	8.6 ± 1.9 (56)	0.07
Expectancy NRS 0–4	3.2 ± 0.7 (105)	3.4 ± 0.6 (43)	*0.05*
Cervical			
Expectancy NRS 0–10	7.9 ± 2.0 (33)	8.5 ± 2.1 (21)	0.31
Expectancy NRS 0–4	3.3 ± 0.6 (18)	3.6 ± 0.5 (14)	0.07
Thoracic			
Expectancy NRS 0–10	8.7 ± 0.8 (6)	9.3 ± 0.8 (7)	0.18
Expectancy NRS 0–4	3.3 ± 0.7 (11)	3.50 ± 0.6 (4)	0.55
Lumbar			
Expectancy NRS 0–10	7.9 ± 2.1 (74)	8.5 ± 1.9 (26)	0.24
Expectancy NRS 0–4	3.2 ± 0.7 (62)	3.3 ± 0.7 (22)	0.49
Sacroiliac			
Expectancy NRS 0–10	8.5 ± 2.6 (10)	8.5 ± 2.1 (2)	1.00
Expectancy NRS 0–4	3.1 ± 0.7 (14)	3.3 ± 0.6 (3)	0.57

SD=standard deviation.
*Two-sided *t* test.

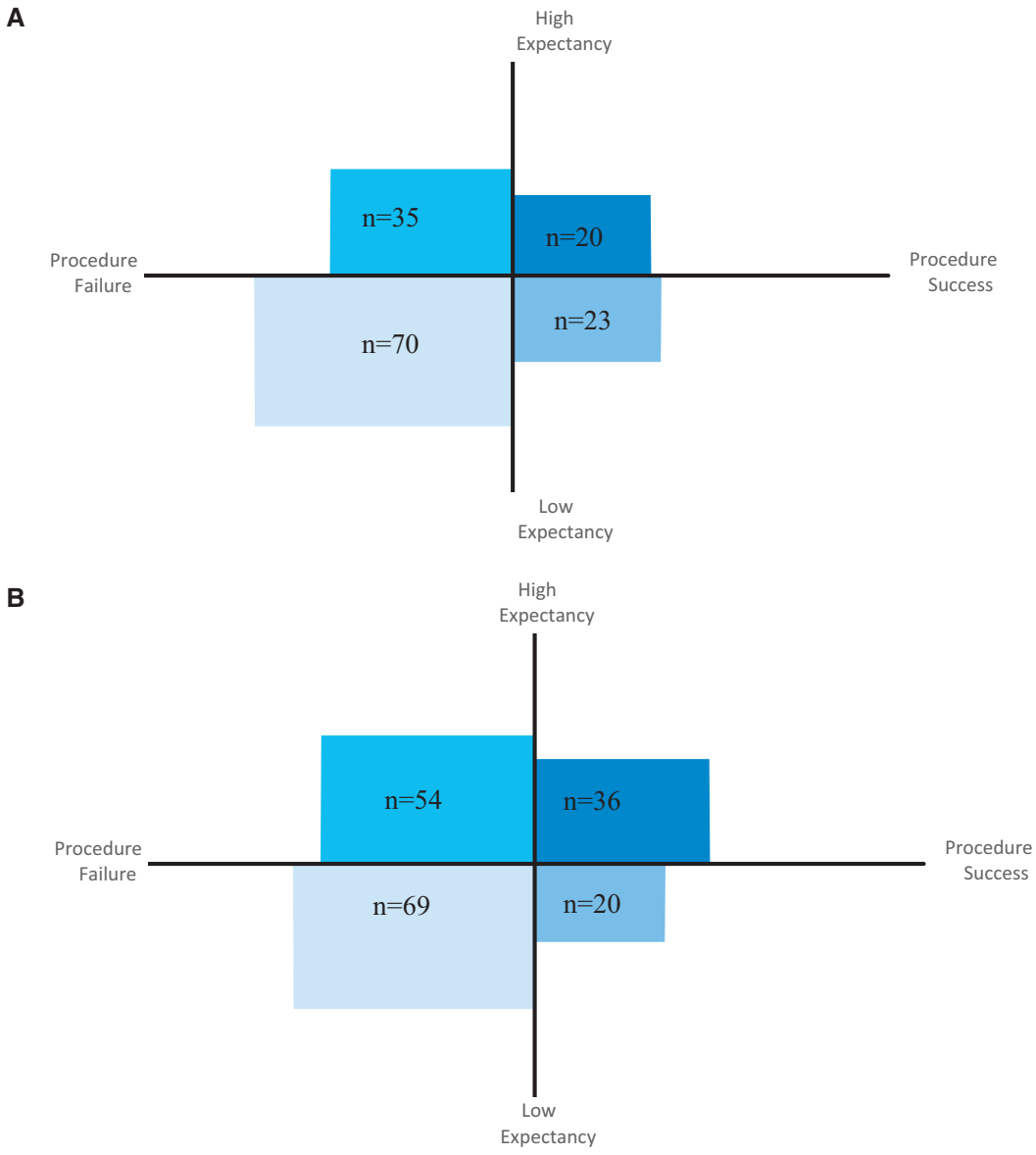

Figure 4. Dichotomous data plots for expectancy vs pain relief for patients experiencing ≤30% pain relief (failure) and ≥75% pain relief (success) in **(A)** the 0–4 NRS cohort, where low expectancy=0, 1, or 2 and high expectancy=3 or 4, and **(B)** the 0–10 NRS cohort, where low expectancy=0, 1, 2, 3, 4, 5, 6, or 7 and high expectancy=8, 9, or 10.

age, and duration of therapy was significantly different only in female patients in only two groups who reported ≥75% pain relief compared with ≤30% pain relief. In the 0–10 expectancy NRS full cohort, the difference was associated with female patients' age, whereas in the full 0–4 female cohort, the difference was associated with duration of therapy (data not shown).

The strength of this study is the extended period of data collection by a single practitioner in the same consistent environment without extraneous variables being engendered.

Limitations

The variables in this study were collected by unsupervised patient self-report. The expectancy questionnaire that was developed, used, and modified has not been validated or subjected to reliability testing. It is an attempt to describe a phenomenon not well addressed in the literature at the time of commencement of this study. It is not attempting to explore to any extent the psychological constructs used to explain "expectancy." Analysis of patient data in this retrospective study was limited to the clinical data points captured at the time of treatment, at neither of which (baseline data point or 3-month point) was the patient provided with any detailed explanation of the questionnaires. Although we found no significant association of expectancy score, hope, and desire with pain outcome across most cohorts, confounding factors, such as the psychosocial factors of fear, personality constructs, and pain perception factors, were not analyzed. Future studies should investigate these factors.

Given the complex cognitive and emotional state being addressed by the questionnaire, it may be preferable

Table 3. Comparison of pre-intervention patient hope and desire scores by pain relief at 3 months after the intervention, noting that their scale was always 0–10

	Hope			Desire		
	Mean ± SD (n)			Mean ± SD (n)		
Expectancy Scale Group	≤30% Pain Relief	≥75% Pain Relief	*P* Value*	≤30% Pain Relief	≥75% Pain Relief	*P* Value*
Overall						
Expectancy NRS 0–10	6.7 ± 3.0 (117)	6.4 ± 2.8 (56)	0.49	7.0 ± 2.96 (117)	6.7 ± 2.9 (56)	0.49
Expectancy NRS 0–4	6.3 ± 3.0 (103)	6.8 ± 3.3 (43)	0.40	6.4 ± 2.9 (103)	7.0 ± 3.2 (43)	0.34
Cervical						
Expectancy NRS 0–10	7.0 ± 3.2 (32)	6.2 ± 2.9 (21)	0.32	7.3 ± 3.0 (32)	6.7 ± 2.9 (21)	0.49
Expectancy NRS 0–4	5.6 ± 3.0 (17)	6.9 ± 3.4 (14)	0.26	6.0 ± 2.9 (17)	6.9 ± 3.4 (14)	0.42
Thoracic						
Expectancy NRS 0–10	9.7 ± 0.5 (6)	7.9 ± 2.7 (7)	0.14	9.7 ± 0.8 (6)	8.1 ± 2.9 (7)	0.22
Expectancy NRS 0–4	6.5 ± 3.2 (11)	5.3 ± 3.2 (4)	0.53	6.7 ± 3.1 (11)	5.3 ± 3.2 (4)	0.44
Lumbar						
Expectancy NRS 0–10	6.2 ± 3.0 (73)	6.2 ± 2.8 (26)	0.94	6.4 ± 2.9 (73)	6.5 ± 2.9 (26)	0.89
Expectancy NRS 0–4	6.5 ± 2.9 (61)	7.2 ± 3.2 (22)	0.34	6.6 ± 2.8 (61)	7.4 ± 3.0 (22)	0.27
Sacroiliac						
Expectancy NRS 0–10	8.8 ± 2.7 (5)	7.0 ± 4.2 (2)	0.51	8.6 ± 2.6 (5)	5.5 ± 3.5 (2)	0.25
Expectancy NRS 0–4	6.3 ± 3.4 (14)	5.0 ± 3.5 (3)	0.56	6.0 ± 3.3 (14)	6.0 ± 3.5 (3)	1.00

SD=standard deviation.
*Two-sided *t* test.

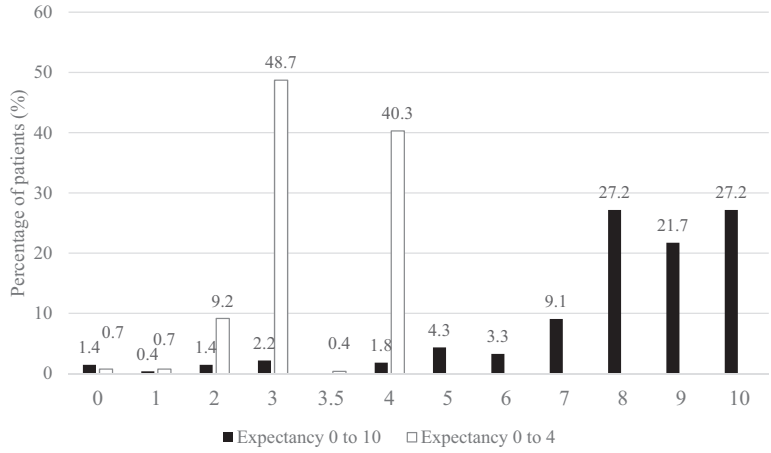

Figure 5. Proportions of patients selecting expectancy scores on the 0–4 NRS and the 0–10 NRS.

to have the patient complete it with some guidance rather than with no explanation at all. Given that the data points showed skewing to one end in both scales, consideration could be given to including a corroborative "reverse expectation" scale asking, "To what extent do you believe that the procedure will not provide any relief?" Furthermore, many patients have pain in other regions, and it is likely that patients, whether reporting worsening of pain, the same pain, or no pain relief at all, may not have interpreted the question as pertaining only to pain related to the target of the intervention site. Further refinement of the questionnaire to be explicit in this regard may help remove this potential bias.

It would be of interest to concurrently offer to a subset of patients undertaking the procedure a negative expectation during the consent process, such as, "When this procedure works well, it works really well, but sometimes we don't get the result that we expect."

These findings may not apply more generally to the wide variety and techniques of pain procedures that are undertaken globally. Each will need to be assessed individually to determine any contribution of expectancy effect. Using a 0–4 scale for assessing expectancy compared with 0–10 conveyed no advantage in attempting to garner a greater spread of responses with less skewing.

Conclusion

These specific procedures with established diagnostic and therapeutic processes, anatomic attributes, and

pathophysiology have been shown to have little-to-no meaningful expectancy effect. This study adds confidence that the pathophysiological mechanisms associated with neurotomy provide the pain relief of these interventional pain treatments, rather than that patient expectancy or treatment context is producing or contributing to a placebo response.

Furthermore, patients presenting for pain management of persistent spinal and sacroiliac pain may warrant diagnosis of such symptomatic joints, , as successful diagnosis-specific and commonly available treatment of thermal neurotomy may then reduce the load on pain management programs in general.

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