Title:
Pain Catastrophizing and Prolonged Opioid Use Following Lumbar Fusion

Maureen P. Lall, MSN
College of Nursing, Texas Woman's University, Denton, TX, USA

Session Title:
Rising Stars of Research and Scholarship Invited Student Posters

Keywords:
lumbar fusion, opioid cessation and pain catastrophizing

References:


**Abstract Summary:**
A prospective cohort study identified significant correlations between prolonged postoperative opioid use (PPO) and preoperative opioid use and being disabled. Multiple regression analysis identified preoperative opioid use as the sole predictor of PPO. Pain catastrophizing was not correlated with PPO or with postoperative pain intensity.

**Learning Activity:**

<table>
<thead>
<tr>
<th>LEARNING OBJECTIVES</th>
<th>EXPANDED CONTENT OUTLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will be able to identify the incidence of prolonged opioid use following lumbar fusion.</td>
<td>The incidence of PPO was calculated by dividing the number of participants who reported continued opioid use at 12 weeks, with no more than 5 opioid-free days since surgery, by the total number of participants.</td>
</tr>
<tr>
<td>The learner will be able to evaluate whether level of pain catastrophizing predicted prolonged opioid use or pain intensity following lumbar fusion.</td>
<td>A Spearman rho statistic was computed to test the hypothesis that level of preoperative pain catastrophizing was positively correlated with time to opioid cessation. The Spearman rho statistic is used instead of Pearson’s r because the variables are not linearly related to one another. The Spearman rho statistic, r(46) = .03, p = .86, did not support a significant correlation between Pain Catastrophizing Scale (PCS) scores and weeks to opioid cessation. The results failed to support the hypothesis that level of preoperative pain catastrophizing is positively correlated with</td>
</tr>
</tbody>
</table>
time to opioid cessation. A Spearman rho statistic was also computed to test the hypothesis that level of preoperative pain catastrophizing was positively correlated with postoperative pain intensity. The Spearman rho statistic, $r(46) = .03, p = .83$, did not support a significant correlation between PCS scores and postoperative Numeric Pain Rating Scale (NPRS) scores. The results failed to support the hypothesis that level of preoperative pain catastrophizing is positively correlated with postoperative pain intensity.

The learner will be able to recognize biopsychosocial predictors of prolonged postoperative opioid use.

Multiple regression analysis using pairwise deletion of missing values and the ENTER method was used to test the hypothesis that time to opioid cessation could be predicted by preoperative patient characteristics. The model summary with eight independent variables showed that $R^2_{adj} = .179$. This indicates that 18% of the variance in weeks to opioid cessation was explained by the combination of the predictor variables. The ANOVA table showed that $F(8,38) = 2.254$ and was significant ($p = .044$). This indicated that the relationship between the independent variables and time to opioid cessation was linear and that the independent variables in the multiple regression equation could predict weeks to opioid cessation. The coefficients table showed the standardized beta coefficient for preoperative opioid use was $\beta = .466$ ($p = .005$). This indicated that preoperative opioid use was the only variable that significantly contributed to the equation predicting prolonged postoperative opioid use.

**Abstract Text:**

Tens of thousands of patients undergo lumbar fusion annually in the U.S. and almost all of them receive a prescription for opioid pain relievers upon hospital discharge. For most patients, prescription opioids provide an effective means of managing pain during the acute recovery period. However, for some patients, prescription opioid use continues for months, even years, following surgery. The prolonged prescribing of opioids by healthcare providers and the continued utilization of opioids by patients occurs despite evidence that long-term opioid use increases the risk of opioid use disorder and drug poisoning death (Centers for Disease Control and Prevention [CDC], 2017).

Previous studies have reported prolonged postoperative opioid use (PPO) rates ranging from 31% (Rouben, Casnellie, & Ferguson, 2011) to 76% (Nguyen, Randolph, Talmage, Succop, & Travis, 2011).
following lumbar fusion. These rates compare unfavorably to PPO rates ranging from 3.2% (Clarke et al., 2014) to 6% (Carroll et al., 2012) following non-spinal surgeries. Previous studies also suggest that pain intensity is not the sole driver of PPO. Instead, younger age, mood disorders, lower household income, tobacco use, alcohol and substance abuse disorders, and pain disorders have been found to predict PPO (Brummett et al., 2017; Carroll et al., 2012; Clarke, Soneji, Ko, Yun, & Wijeysundera, 2014; Goesling et al., 2016; Helmerhorst, Vranceanu, Vrahas, Smith, & Ring, 2014).

Pain catastrophizing is a negative, cognitive-affective response to pain that is characterized by exaggerated negative perceptions during actual or anticipated pain experiences (Sullivan et al., 2001). It was shown to predict opioid dose during the first 48 hours following lumbar fusion (Papaioannou et al., 2009). This finding suggested a possible role for pain catastrophizing in predicting PPO following lumbar fusion.

Methods

Study setting and participants

Using the biopsychosocial model of illness as a conceptual framework (Engel, 1977), the researcher conducted a prospective, longitudinal, correlational study to identify the incidence and predictors of PPO in a cohort of patients undergoing elective lumbar fusion. The researcher used consecutive sampling and enrolled 57 participants from a single site. Enrollment rate was 100%. The study was approved by an institutional review board and participants provided written informed consent.

Measures

On the day of surgery, the researcher administered the Demographic and Clinical Variables Questionnaire and the Pain Catastrophizing Scale (PCS). The Demographic and Clinical Variables Questionnaire measured: (a) age, (b) sex, (c) preoperative pain intensity, (d) preoperative opioid use, (e) employment status, and (f) educational level.

The PCS is a 13-item self-report measure of pain-related catastrophic thinking (Sullivan, 2009). There is evidence to support the reliability and validity of the PCS when used with patients undergoing lumbar fusion (Papaioannou et al., 2009). The PCS yields a total summed score ranging from 0-52, with higher scores indicating greater pain catastrophizing.

Three months following lumbar fusion, the researcher interviewed each participant via telephone to identify weeks to opioid cessation and postoperative pain intensity. Time to opioid cessation was defined as the number of weeks from lumbar fusion until the first of 5 consecutive days of zero opioid use (Carroll et al., 2012).

Statistical Analysis

All data analyses were conducted with Statistical Package for the Social Sciences (SPSS), version 24. The researcher used correlation values from a previous study of lumbar fusion outcomes to estimate effect size. In the study, the correlation between PCS scores and opioid dose was $r = .53$, and the correlations between PCS scores and postoperative pain ratings ranged from $r = .72$ to .89 (Papaioannou et al., 2009). The researcher used the smallest of these correlations ($r = .53$) as a direct estimate of effect size and anticipated a large effect. This estimate correlated to a minimum sample size of $n = 41$ to conduct multiple regression with seven independent variables. To allow for attrition, the researcher recruited 57 participants.

Results
A total of 57 participants enrolled in the study. The mean age of the cohort was 63.47 (SD = 11.05), and more than half of participants (54.4%, n = 31) were retired. Two-thirds (66.7%, n = 38) of participants were female and one-third (33.9%; n = 19) had at least an Associate’s degree. More than 60% of the participants (61.4%, n = 35) were using opioid pain relievers prior to lumbar fusion. The mean preoperative NPRS score was 7.65 (SD = 1.87) and mean PCS score was 28.85 (SD = 14.72). The mean time to opioid cessation was 7.76 weeks (SD = 4.47) and the mean postoperative NPRS score was 3.12 (SD = 2.15). Internal consistency evaluation of the PCS indicated a Cronbach’s alpha = .951.

Incidence of Prolonged Opioid Use Following Lumbar Fusion

The incidence of PPO was 44% (n = 22). That is, 44% of participants reported opioid pain reliever use for low back or leg pain 3 months following surgery, with no more than 5 opioid-free days since surgery.

Correlation of Pain Catastrophizing with Postoperative Outcomes

No statistically significant correlations were found between pain catastrophizing and postoperative outcomes. The researcher used a nonparametric test, the Spearman rho statistic, because the variables were not linearly related. The Spearman rho statistic did not reveal significant correlations between PCS scores and weeks to opioid cessation [r(46) = .03, p = .86] or postoperative NPRS scores [r(46) = -.04, p = .82].

Predictors of Prolonged Postoperative Opioid Use

Prior to executing multiple regression, the researcher transformed and recoded educational level and employment status into dichotomous variables. The researcher also deleted one participant from multiple regression analysis as an outlier on age. Multicollinearity assessment did not reveal any redundant variables.

The researcher used pairwise deletion and the ENTER method. The correlation matrix showed weeks to opioid cessation was highly correlated with preoperative opioid use (r = .458, p = .000) and moderately correlated with disabled (r = .290, p = .022). The model summary showed R = .567, R² = .322, and R²adj = .179. This indicates that 18% of the variance in weeks to opioid cessation was explained by the combination of the predictor variables. The ANOVA table showed F(8,38) = 2.254 and was significant (p = .044). This indicated that the relationship between the independent variables and time to opioid cessation was linear and that the independent variables could predict weeks to opioid cessation. The coefficients table indicated that preoperative opioid use significantly contributed to the equation predicting weeks to opioid cessation with a standardized beta coefficient of .466 (p = .005). Thus, preoperative opioid use was the sole independent variable in the multiple regression that significantly contributed to the prediction of time to opioid cessation.

Discussion

More than forty percent of participants in the current study (n = 22; 44.0%) reported PPO following lumbar fusion. This high rate of PPO is consistent with previous findings (Nguyen et al., 2011; Rouben et al., 2011).

Pain catastrophizing was not significantly correlated with time to opioid cessation or with postoperative pain intensity. This was somewhat surprising given the number of previous studies that identified significant positive correlations between pain catastrophizing and negative pain-related outcomes (Wertli et al., 2014). This finding may indicate that the impact of pain catastrophizing is changing in the context of the opioid epidemic. Perhaps patients who catastrophize are becoming hypervigilant to the possibility of opioid use disorder and drug poisoning death and are, now, less likely to experience negative outcomes.
Preoperative opioid use emerged as the sole predictor of time to opioid cessation. This finding is consistent with prior research findings (Armaghani et al., 2014; Carroll et al., 2012; Rozet et al., 2014). However, preoperative opioid use accounted for only 18% of the variance in time to opioid cessation; suggesting that additional variables that were not examined in the present study may predict PPO.

Strengths and Weaknesses

Strengths of the study include the use of consecutive sampling, 100% enrollment rate, excellent retention and follow-up, longitudinal design, and the use of measurement items and instruments with strong evidence of reliability and validity. Weaknesses include the use of self-report to identify time to opioid cessation and postoperative pain intensity. The sample size could also be considered a weakness because it was calculated to detect a large effect. It is possible that the study was too underpowered to detect small and medium effects and that a larger sample would have identified additional predictors of time to opioid cessation.

Conclusion and Future Directions

Pain management following lumbar fusion is complex. The incidence of PPO is high despite the potential harms of long-term opioid therapy. However, identifying preoperative opioid use as a significant predictor of time to opioid cessation suggests that it may be possible to identify patients at risk of PPO prior to surgery. This would be a first step in preventing the transition to PPO. Once identified, high-risk patients could be targeted for additional intervention emphasizing the use of non-opioid and non-pharmacological strategies during postoperative recovery, all of which require further study.