Predicting Opioid-Dependence Using Pain Intensity And Length Of Pain Suffering In Pre-Spine-Surgery Patients

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Citation

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Abstract

Introduction: The purpose of this study was to evaluate the diagnostic value of pain intensity and length of pain suffering as OD markers.

Methods 150 patients pre-spine-surgery who were on opioids were questioned preoperatively to determine OD based on the WHO guidelines. Logistic regression analysis was used to identify the most significant factors-predictors of OD status in pre-spine-surgery patients. Sensitivity, specificity, positive and negative predictive values (PPV, NPV) and efficiency for different pain-related parameters were calculated in accordance with standard formulas. Receiver operating characteristic (ROC) curves were obtained using SPSS.

Results 30 (20%) patients met the WHO criteria for OD. We excluded those with missing pain data and out of 132 pre-spine-surgery patients 29 (22%) were OD. Using logistic regression analysis we proved that pain-related parameters were the only significant predictors of OD status in pre-spine-surgery patients with WRI showing the highest significance (p=0.003). Other variables like type of surgery, gender, race and number of previous spine surgeries showed no significance. Sensitivity and specificity for pain intensity ≥8 were 76% and 45% respectively. PPV, NPV and efficiency were 28%, 80% and 52% respectively. Sensitivity and specificity for ≥24 months pain suffering were 48% and 57% respectively. PPV, NPV and efficiency were 24%, 80% and 55% respectively. The average value of the WR index for OD patients was 660. Sensitivity and specificity for the WR index ≥660 were 34% and 92% respectively. PPV, NPV and efficiency were 56%, 83% and 80% respectively. The WR index ROC curve most closely followed the left-hand border.

Conclusions Chronic pain and prolonged use of opioids raise the risk of OD in pre-spine-surgery patients to 20-22%. Pain-related parameters are significant predictors of OD status in this category of patients. On the other hand, pain intensity ≥8 and length of pain suffering ≥24 months do not have sufficiently high sensitivity and specificity. The WR index ≥660 has a very high specificity as marker for OD. It also proved to be the most accurate/efficient. However, the low positive predictive values for all these parameters make them unreliable as screening markers for OD in pre-spine-surgery patients.

INTRODUCTION

Predicting opioid-dependence (OD) in patients with chronic nonmalignant pain is a clinical challenge to clinicians. To date, most decisions about opioid prescriptions and patients' behaviors are based on unexamined or erroneous assumptions, without empirically validated guidelines or markers. A biopsychosocial approach[1] to this problem has been suggested. It depends on the use of multiple sources of information in multiple areas to gain a comprehensive understanding of the problem. However, with addiction, it is difficult to predict who will go on to develop problems even if the patient does not seem on the initial comprehensive evaluation to be at risk. Continued monitoring can prevent any potential problems that might develop. Fortunately, a patient who has started an opioid medication can be switched, if necessary, to nonopioid alternatives early in the treatment. A screening marker that could help guide a clinician's judgment about who may be at risk for problematic opioid behavior would be of great value. Currently, however, there are virtually no widely used or accepted markers to screen for potential problematic opioid behavior in chronic pain patients. Turk and Okifuji[2] examined the factors that influenced a physician's decision

to prescribe opioids to patients attending a multidisciplinary pain treatment center. Overt pain behaviors seemed to have the major influence on a physician's decision to prescribe opioids even though patients were comparable with regard to other psyhosocial and physical variables. They also highlighted the fact that opioid medication may serve as a reinforcer for pain behavior such that patients who receive opioids continue to display pain behaviors to solicit further prescriptions from their physicians. These pain behaviors typically do not correlate with underlying physical pathologic findings. They highlighted the need for more objective ways of determining who can receive opioid treatment and who is vulnerable to OD.

Back injury patients are among those highly exposed to OD which is a growing concern for neurosurgeons. Predicting OD in these patients is of utmost importance for the ideal management of their postoperative pain. In a previous study we determined that 20% of pre-spine-surgery patients met the criteria for OD_3. We also found a significant correlation between OD and length of pain suffering ($r=0.22$, $p<0.05$) and a very significant correlation ($r=0.24$, $p<0.01$) between OD and pain intensity and ($r=0.30$, $p<0.01$) between OD and the WR index (pain intensity x length of pain suffering in months)$_3$. The average value of the WR index for opioid-dependent pre-spine-surgery patients was 660. The purpose of this study was to evaluate the diagnostic and predictive significance of pain-related parameters as markers for OD in pre-spine-surgery patients.

MATERIALS AND METHODS

We interviewed 150 patients undergoing spine surgery who were using an opioid medication for pain relief [48 lumbar diskectomy (LMD), 60 cervical decompression and fusion (CDF) and 42 lumbar decompression and fusion (LDF)] using a questionnaire$_3$ based on the World Health Organization (WHO 1964) and the DSM-IV-TR (2002) guidelines for the diagnosis of “dependence” that require at least three out of six criteria.

The prevalence of OD in spine surgery patients was determined based on the questionnaire results. We studied pain-related markers – pain intensity and length of pain suffering - diagnostic and predictive values in OD. Pain intensity was quantified upon admission using the 0-10 pain scale. We also used the Walid-Robinson Index (WRI) as a complex parameter.

Logistic regression analysis was used to identify the most significant factors-predictors of OD status in pre-spine-surgery patients. Specificity, sensitivity, predictive values and efficiency were calculated in accordance with standard formulas. Receiver operating characteristic (ROC) curves were obtained using statistical software “SPSS”.

RESULTS

Overall, 30 (20%) patients met the WHO and DSM-IV-TR criteria for OD. We excluded those with missing pain intensity or length of pain suffering data and out of the left 132 (43 lumbar diskectomy, 52 cervical decompression and fusion and 37 lumbar decompression and fusion) pre-spine-surgery patients 29 (22%) were opioid-dependent.

Logistic regression analysis showed pain intensity upon admission; length of pain suffering and WRI were the only significant predictors of OD status among studied variables in pre-spine-surgery patients (Table 1). WRI proved the most significant at all ($p=0.003$).

Figure 1

Table 1: Factors-predictors of OD status

		Score	df	Sig.
Variables	ToS	1.053	1	.305
	Age	2.486	1	.115
	NoPSS	.007	1	.936
	Gender	.923	1	.337
	Race	.307	1	.580
	PainIntens	5.904	1	.015*
	PainLength	5.290	1	.021*
	WRI	8.800	1	.003**
Overall Statistics		18.147	8	.020

* P<0.05

** P<0.01

ToS: Type of surgery

NoPSS: Number of previous spine surgeries

PainIntens: Pain intensity upon admission (from 0 to 10)

PainLength: Length of pain suffering (in months)

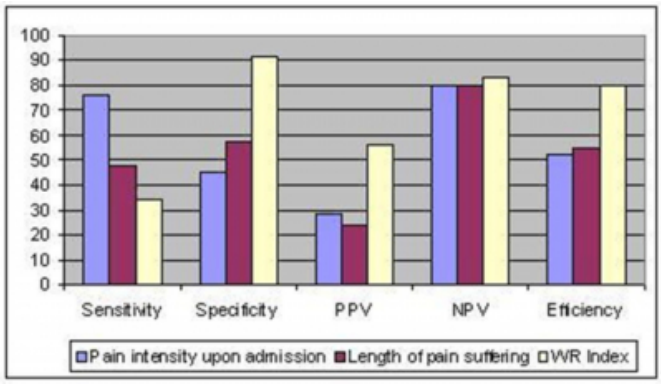
WRI: Walid-Robinson Index

We calculated sensitivity, specificity, predictive values and efficiency for the studied parameters. The sensitivity and specificity of the maximum pain intensity (10) were 40% and 83% respectively. The positive and negative predictive

values for this parameter were also 40% and 83% respectively. The efficiency of the parameter was 73%. The sensitivity and specificity of a pain intensity of 8 and higher were 76% and 45% respectively. The positive and negative predictive values for this parameter were 28% and 80% respectively. The efficiency of the parameter was 52%. The sensitivity and specificity of 24 months pain suffering and longer were 48% and 57% respectively. The positive and negative predictive values for this parameter were 24% and 80% respectively. The efficiency of the parameter was 55%. The sensitivity and specificity of the WR index (660) were 34% and 92% respectively. The positive and negative predictive values for this parameter were 56% and 83% respectively. The efficiency of the parameter was 80% (Figure 1).

Figure 2

Figure 1: Specificity, sensitivity, predictive values and efficiency of pain parameters regarding OD in pre-spine-surgery patients



DISCUSSION

The struggle to bring the abstract, but ever so real, experience of "pain" within the boundaries of quantitative science continues to be no mere academic exercise. Pain measurement would enable the prospect of better understanding of pain-OD relationship.

Pain as defined by the International Association for the Study of Pain[4]: An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Pain is always subjective. Many people report pain in the absence of tissue damage or any likely pathological cause; this usually happens due to psychological reasons. There is no way to distinguish their experience from that resulting from tissue damage if we take the subjective report. If they regard their experience as pain and if they report it in the same ways as pain caused by tissue damage, it should be accepted as pain. This definition avoids tying pain to the stimulus. Pain is a psychological state and the most commonly used method to evaluate its intensity is to ask the patient to estimate his/her own pain on a 0-10 scale. Length of pain suffering is probably a more objective parameter since the first referral to pain may be documented in the patient's chart. Yet, it is usually obtained during patient interview.

Opioids are widely prescribed for patients with chronic pain including patients with disk hernia and spinal stenosis. Our study showed a fifth (20-22%) of pre-spine-surgery patients to be opioid-dependent according to WHO and DSM-IV-TR criteria. Prevalence of OD was required in order to calculate the predictive values of pain-related markers – pain intensity and length of pain suffering - later in the study.

OD is a categorical variable with two levels "OD" and "No OD". Logistic regression is used for binary categorical variables like OD status. Using this analysis we proved that pain-related parameters were the only significant predictors of OD status in pre-spine-surgery patients with WRI showing the highest significance (p=0.003). Other variables like type of surgery, gender, race and number of previous spine surgeries showed no significance.

We calculated the diagnostic and predictive values of these parameters in OD. It is known that sensitivity and specificity of a test do not depend on the prevalence (pre-test probability) of disease. The sensitivity and specificity for the maximum pain intensity (10) were 40% and 83% respectively. This was expected because the stricter diagnosis criteria are the less sensitive and the more specific they are. We, then, lowered the cutpoint for pain intensity and calculated the sensitivity and specificity for pain intensity 8 and higher. They were 76% and 45% respectively. The sensitivity increased to 76%, which was still not sufficiently high to be useful knowing that a sensitive test when negative rules out disease and, on the other hand, the specificity decreased. Thus, there is a tradeoff between sensitivity and specificity. Resetting the cutpoint can improve one of them but at the expense of the other. The sensitivity and specificity of 24 months pain suffering and longer were 48% and 57% respectively. This marker showed low sensitivity and specificity and proved useless in OD.

Sensitivity and specificity by themselves are only useful when either is very high (typically, ≥95%)[5]. Predictive

values are more useful to clinicians because the main question for them is: Given a positive (or negative) test result, what is the probability of disease? But, they vary with the prevalence of this disease. Each pair of predictive values (post-test probabilities) is associated with a single pre-test probability. Changing the pre-test probability changes the predictive value in a non-linear way. The positive and negative predictive values for maximum pain intensity (10) were also 40% and 83% respectively. The positive and negative predictive values for pain intensity 8 and higher were 28% and 80% respectively. The positive and negative predictive values for length of pain suffering 24 months and longer were 24% and 80% respectively.

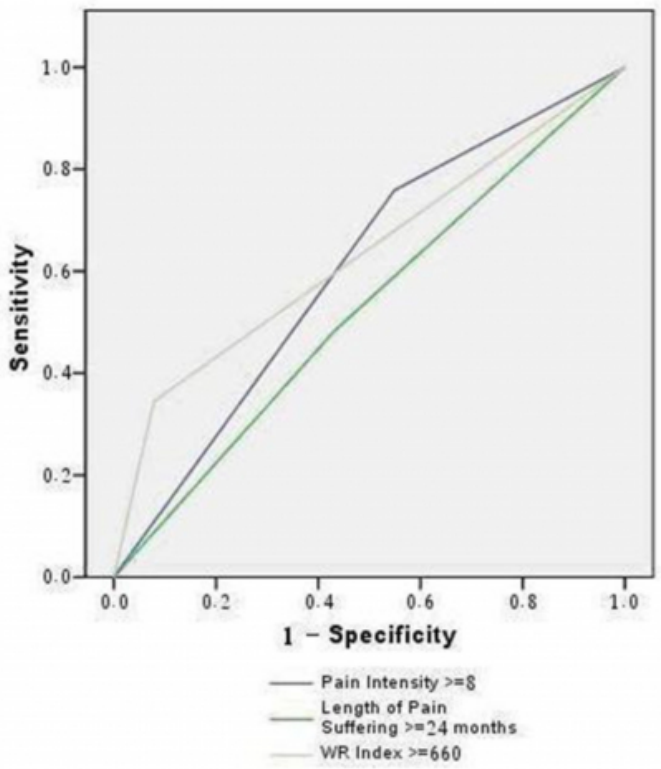
We also studied the diagnostic and predictive value of the WR index. The average value of the WR index for OD patients was 660. The sensitivity and specificity of the WR index (660) were 34% and 92% respectively. It is known that a very specific test, when positive, rules in disease. The positive and negative predictive values for this parameter were 56% and 83% respectively. The low positive predictive values for all studied parameters are due to the <90% sensitivity and <50% prevalence rate and make them unreliable as screening markers for OD in pre-spine-surgery patients.

Efficiency of a test is the percentage of times that the test gives the correct answer. The efficiency for pain intensity 8 and higher was 52%. The efficiency of 24 months pain suffering and longer was 55%. The efficiency of the WR index was 80%. The WR index proved to be the most efficient marker in OD.

The ROC curve - a plot of the true positive rate against the false positive rate for a diagnostic test or marker – of the WR index ≥660 most closely followed the left border of the graph (Figure 2) because it was the most accurate/efficient of the studied pain parameters as a marker for OD in pre-spine-surgery patients.

Figure 3

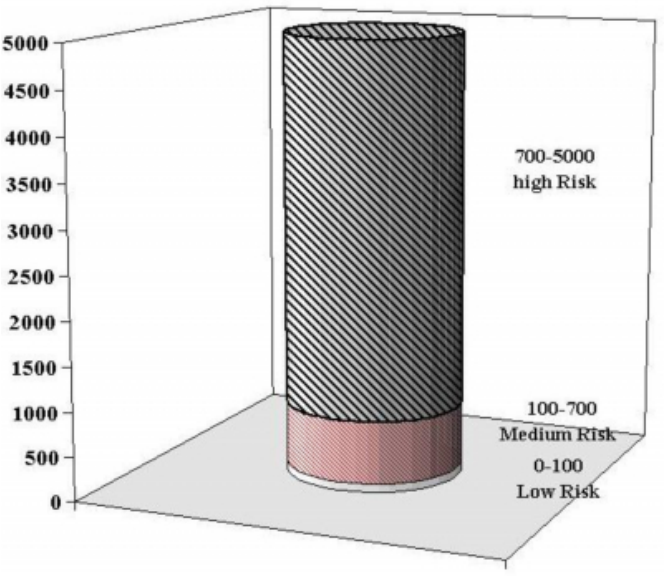
Figure 2: ROC curves for various pain parameters



We suggest the following ranges of WRI matching the risk of OD in spine surgery patients (Figure 3). Of course, this new parameter requires further investigation and probing regarding OD with potential modification.

Figure 4

Figure 3: The WR Index for the Prediction of OD in Pre-Spine Surgery Patients



This study has several limitations. Most important, we did not covary for other significant variables of influence, like type and dose of opioid medications and postoperative analgesia. These factors should be implicated in future studies on the topic of opioid dependence in spine surgery patients.

CONCLUSIONS

Chronic pain and prolonged use of opioids raise the risk of OD in pre-spine-surgery patients to 20-22%. Pain-related parameters are significant predictors of OD status in this category of patients. On the other hand, pain intensity ≥8 and length of pain suffering ≥24 months do not have sufficiently high sensitivity and specificity. The WR index ≥660 has a very high specificity as marker for OD. It also proved to be the most accurate/efficient. However, the low positive predictive values for all these parameters make them unreliable as screening markers for OD in pre-spine-surgery patients.

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References

1. Robinson, Richard C.; Gatchel, Robert J.; Polatin, Peter; Deschner, Martin; Noe, Carl; Gajraj, Noor. Screening for Problematic Prescription Opioid Use. Clinical Journal of Pain. 17(3):220-228, September 2001.
2. Turk DC, Okifuji A. What factors affect physicians' decisions to prescribe opioids for chronic noncancer pain patients? Clin J Pain 1997; 13:330-6.
3. Walid MS, Hyer LA, Ajjan M, Barth ACM, Robinson JS. Prevalence of opioid-dependence in spine surgery patients and correlation with length of stay. J Opioid Management 2007, Volume 3, Number 3.
4. Classification of Chronic Pain, Second Edition, IASP Task Force on Taxonomy, edited by H. Merskey and N. Bogduk, IASP Press, Seattle, © 1994, pp 209-214.
5. Mark H. Ebell, MD, MS. An Introduction to Information Mastery
1999. Internet: http://www.poems.msu.edu/InfoMastery/

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