

## Are Psychological Predictors of Chronic Postsurgical Pain Dependent on the Surgical Model? A Comparison of Total Knee Arthroplasty and Breast Surgery for Cancer

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**Abstract:** Anxiety, depression, and catastrophizing are generally considered to be predictive of chronic postoperative pain, but this may not be the case after all types of surgery, raising the possibility that the results depend on the surgical model. We assessed the predictive value of these factors for chronic postsurgical pain in 2 different surgical models: total knee arthroplasty for osteoarthritis (89 patients, 65% women, age = 69 ± 9 years, baseline pain intensity = 4.7 ± 2.1) and breast surgery for cancer (100 patients, 100% women, age = 55 ± 12 years, no preoperative pain). Data were collected before surgery, then 2 days and 3 months after surgery. Anxiety, depression, and catastrophizing were measured with the Spielberger State-Trait Anxiety Inventory, Beck Depression Inventory, and Pain Catastrophizing Scale, respectively. Pain was assessed with the Brief Pain Inventory. Neuropathic pain was detected with the DN4 questionnaire. Multivariate logistic regression analyses for the total knee arthroplasty and breast surgery models considered together indicated that the presence of clinically meaningful chronic pain at 3 months (pain intensity  $\geq 3/10$ ) was predicted independently by age ( $P = .04$ ), pain intensity on day 2 ( $P = .009$ ), and state anxiety ( $P = .001$ ). Linear regression models also showed that pain magnification, one of the dimensions of catastrophizing, independently predicted chronic pain intensity ( $P = .04$ ). These results were not affected by the surgical model or by the neuropathic characteristics of the pain. Thus, state anxiety and pain magnification seem to constitute psychological risk factors for chronic postsurgical pain relevant in all surgical models.

**Perspective:** This prospective study performed in patients with total knee arthroplasty or breast surgery for cancer shows that state anxiety, amplification of pain, and acute postoperative pain independently predict postsurgical pain at 3 months and that this does not depend on the surgical model.

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**Key words:** Postsurgical pain, anxiety, depression, catastrophizing, neuropathic pain, total knee arthroplasty, breast surgery.

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Chronic postsurgical pain is a significant health problem.<sup>24,27</sup> The impact of sociodemographic and physical factors has been largely demonstrated (see<sup>20,24</sup> for reviews) and the role of psychological factors has been evaluated more recently in prospective studies (for reviews, see<sup>19,20,24,27,48</sup>). Anxiety and depression have been evaluated most frequently,<sup>19</sup> but pain cognition, including catastrophizing in particular, is increasingly being considered.<sup>27,48</sup> However, discrepant results have been reported regarding the role of these predictors in chronic postsurgical pain and their relationship. For example, preoperative

anxiety and depression have been found to be predictive of chronic postsurgical pain, particularly after musculoskeletal surgery,<sup>48</sup> but not after other types of surgery (eg, prostatectomy, chest surgery, hysterectomy, herniotomy)<sup>8,14,28</sup> or were not independently associated with pain after breast surgery.<sup>36</sup> Other studies have shown that only early postoperative depression was predictive of chronic pain after spine surgery.<sup>41</sup> Similarly, pain catastrophizing has been found to be predictive of chronic pain after total knee arthroplasty (eg,<sup>11,45</sup>) or spine surgery,<sup>2,10</sup> but not after chest surgery<sup>28</sup> or hysterectomy.<sup>8</sup> Catastrophizing assessed 1 month after limb amputation has even been found to predict a favorable outcome 5 to 12 months later.<sup>16,21</sup> All these studies were performed in single surgical models, making it impossible to determine whether the role of psychological predictors is dependent on the surgical model or similar in various types of surgery, despite the heterogeneity of procedures, age and sex, the presence or absence of preoperative pain, the benignity or malignancy of the lesion, and the distinct quality of postoperative pain.

We addressed this question by comparing the extent to which affect (anxiety, depression) and pain cognition (catastrophizing) were predictive of the prevalence and intensity of chronic postsurgical pain 3 months after the intervention, in 2 different surgical models: total knee arthroplasty (TKA) for osteoarthritis, a benign intervention mostly carried out in elderly people having chronic preoperative pain<sup>45,46</sup>; and breast cancer surgery, mostly in younger women with little or no preoperative pain.<sup>12</sup> We hypothesized that it might be possible to detect predictive affective or cognitive risk factors common to both these surgical models, despite their heterogeneity, which therefore could be considered potentially "invariant" risks for chronic postsurgical pain. These surgical models also induce different types of pain: mostly non-neuropathic pain in the TKA model and neuropathic pain in the breast surgery model. We therefore also assessed the impact of the same predictive variables on pain with neuropathic characteristics (NC) in both models.

## Methods

### *Participants and Procedure*

The study sample consisted of 2 groups of patients undergoing TKA or breast cancer surgery, recruited between May 2008 and September 2011. The study was approved by the local ethics committee (Comité de Protection des Personnes Ile-de-France VIII), and all patients were asked to provide informed consent for the study.

TKA patients were recruited from the Raymond Poincaré Hospital (APHP, Garches, France). Eligible patients were women or men aged 18 to 85 years, scheduled for unilateral TKA for osteoarthritis of the knee. Patients were not included if they had conditions other than osteoarthritis necessitating TKA (eg, rheumatoid arthritis, spondylarthropathy), required bilateral TKA, or had undergone previous knee surgery. Surgery was performed in the same surgical ward in each case, by 1 of 3 highly

experienced surgeons, in an identical, standardized protocol (median skin incision, paramedial arthrotomy, condylar femoral and tibial components implanted and cemented). The anesthetic procedure was similar for all patients and combined propofol, sufentanil, a muscle relaxant, and sevoflurane. In all patients, postoperative pain was controlled by intravenous morphine patient-controlled analgesia together with intravenous acetaminophen, ketoprofen, and a femoral peripheral nerve block. At follow-up, all the radiographic data confirmed that all implants were well aligned mechanically and that implant placement was satisfactory. There was no evidence of ligament instability, and none of the patients displayed implant displacement at the time of assessment.

The second group of patients consisted of women aged 18 to 85 years recruited from René Huguenin Hospital (Saint Cloud, France) for mastectomy or lumpectomy to treat breast cancer, with axillary lymph node dissection in all cases. The intercostobrachial nerve is more likely to be damaged in these conditions, and this damage may result in chronic neuropathic pain.<sup>36</sup> Surgery was performed in the same surgical ward in each case, by 1 of 5 surgeons, according to an identical procedure. The lumpectomy and mastectomy groups did not differ in terms of the incidence or severity of postsurgical pain, as previously reported,<sup>36</sup> and were therefore analyzed together. Furthermore, the choice of surgeon had no impact on the prevalence or intensity of pain at 3 months (not shown). Women were not included if they had any past surgery of the thoracic or cervicobrachial region, including prior mastectomy or lumpectomy; were scheduled for lumpectomy for a benign tumor, for bilateral mastectomy, or for a second breast surgery procedure during the 3 months of follow-up; had other malignant conditions or evidence of distant metastases (apart from lymph node macrometastases); or had undergone radiotherapy or chemotherapy before surgery. Data for radiotherapy and chemotherapy during the 3 months following surgery were obtained from the patients' medical reports or were directly reported by the patients. The anesthetic procedure was similar for all patients: general anesthesia was induced with propofol, sufentanil, and atracurium or cisatracurium, to facilitate orotracheal intubation. Anesthesia was maintained with nitrous oxide, sevoflurane, or desflurane and boluses of sufentanil, as required. In all patients, postoperative pain was controlled by intravenous acetaminophen.

All the patients in both surgical groups were native French speakers. We did not include patients with clinically significant or unstable psychiatric or somatic conditions (eg, major depression, psychosis, uncontrolled diabetes mellitus or hypertension, neurologic disorders, immune disease, or body mass index >45), cognitive impairment, or past or present substance abuse.

Participants were asked to complete questionnaires about their demographic characteristics, trait anxiety, and catastrophizing 1 month prior to surgery and then were again questioned about their pain status and intensity, state anxiety, and depression the day before surgery in the presence of a certified psychologist (A.M.-D. or S.B.). Because state and trait anxiety do not measure the same dimension of anxiety, they

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