

# Assessment of Postoperative Pain After Laryngeal Surgery for Cancer

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**Objectives:** To assess the intensity of postoperative pain after laryngeal surgery for cancer and the efficacy of analgesic injections at fixed hours.

**Design:** A prospective clinical study performed during the 3 days following laryngeal cancer surgery.

**Setting:** A university medical center.

**Patients:** Fifteen men (age range, 38-74 years) having just undergone a partial or total laryngectomy for epidermoid carcinoma.

**Interventions:** The analgesic treatment consisted of intravenous administrations at fixed hours (propacetamol or nalbuphine hydrochloride), with the possibility of rescue doses on demand. Pain and anxiety were assessed by means of visual analog scales (graduated from 0-10) every 3 hours on postoperative day 1, then every 6 hours on postoperative days 2 and 3. Objective criteria, ie, heart and respiratory rates and mean

blood pressure, were measured with the same schedule.

**Main Outcome Measures:** Postoperative pain and anxiety intensities and their variations were analyzed. Correlations between postoperative pain and other criteria were researched.

**Results:** Postoperative pain had a high initial level (maximum median, 7), then decreased and reached a score of 3 at the 30th hour. Unpredictable individual peaks of pain were reported. Anxiety was never high (maximum median, 4). No individual correlation was found between pain and objective parameters.

**Conclusions:** After laryngeal surgery for cancer, pain can reach high levels, particularly in the first hours following recovery. Analgesic administrations at fixed hours are not effective enough. Postoperative analgesic treatment should aim to prevent the high initial pain and be individually adapted.

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PAIN WAS recognized as a real clinical challenge in 1976, the date of the First World Congress on Pain.<sup>1</sup> Since then, many advances have been realized concerning the physiological characteristics of pain and consequently the clinical management of patients in pain. However, acute postoperative pain (POP) is often erroneously considered a minor problem.<sup>2</sup> In fact, many medical teams tend to neglect the treatment of pain, giving high priority to the treatment of its cause,<sup>2</sup> sometimes even delegating pain relief to the nursing staff.<sup>3</sup> Obtaining pain relief, especially after surgery, should be recognized as a major goal for evident humanitarian reasons, but also for economical ones since it has been proven that effective pain relief is linked with lower morbidity, and consequently can shorten the hospital stay.<sup>2</sup>

Concerning head and neck surgery, evaluation of pain mainly has been performed after tonsillectomy.<sup>4-6</sup> In a search

of the literature, we did not find any articles related to the assessment of pain following laryngeal surgery. Evaluation of POP in patients undergoing surgery for laryngeal and hypopharyngeal cancer requires particular care because of obvious difficulties with communication.<sup>7,8</sup> Furthermore, in the case of total resection of the larynx, the mutilation induced by the operation may cause many troubles, notably psychological issues such as anxiety,<sup>9</sup> that in turn can worsen pain.<sup>2,10,11</sup>

In a prospective study, we attempted to assess the intensity of pain after laryngeal surgery for cancer. The main goal was to know whether patients felt pain after this type of surgery. The chosen method of investigation, ie, assessment by means of visual analog scales (VASs), had to be validated and as minimally intrusive as possible to fit the case of patients unable to speak and, in some cases, to write after surgery. Because no consensus has yet been established concerning the most

## PATIENTS AND METHODS

### PATIENTS

Fifteen patients undergoing surgery for laryngeal or hypopharyngeal epidermoid carcinoma, requiring a partial or total laryngectomy, took part in this study. Informed consent was obtained from all patients. Inclusion was decided during the systematic preanesthesia consultation, when it was clear that there was no contraindication to the use of the analgesic drugs prescribed. All patients were male. The mean ( $\pm$ SD) age was 60.2 $\pm$ 11.5 years (age range, 38-74 years). The mean ( $\pm$ SD) weight was 67.8 $\pm$ 10.4 kg. Patients' tumors were staged according to the TNM staging system (International Union Against Cancer [UICC] classification, 1988). Patient characteristics, tumor staging, and type of surgery are summarized in the **Table**.

### METHODS

In the first 3 postoperative days, we evaluated the intensity of POP, anxiety, and pain relief with VASs. These scales consisted of horizontal lines graduated from 0 to 10, with 2 end points labeled on the front side: "no pain" to "worst pain," "no anxiety" to "maximal anxiety," and "no relief of pain" to "total relief of pain." Patients were asked to quantify the level of pain and anxiety they were experiencing at the moment of the assessment, just before the analgesic administration. The pain relief was evaluated 45 minutes after the analgesic injection, with respect to the score of pain indicated just before this injection. However, the scores of POP and pain relief were so closely related that only POP is reported herein. The assessments of heart rate (radial pulse) and respiratory rate were performed by the nurses for 1 minute. Mean blood pressure (MBP) was measured with an automatic sphygmomanometer set around the

arm (Dinamap 1846, Critikon, division of Johnson & Johnson Medical Inc, Tampa, Fla).

The first evaluation was performed when the patient had just recovered from anesthesia, immediately before he was taken from the recovery room, at the time defined as hour 0 (H0). The assessments were then performed every 3 hours in the first 24 hours, and every 6 hours in the following 48 hours, that is, until the postoperative 72nd hour (H72). Overall, we collected 17 data points per patient for each postoperative criterion.

The same analgesic regimen, consisting of intravenous analgesic administrations, was prescribed for all patients: 2 g of intravenous propacetamol at H0, and then, alternatively, either a subcutaneous injection of 20 mg of nalbuphine hydrochloride (at H3, H9, H15, H21, H30, H42, H54, and H66) or 2 g of intravenous propacetamol (at H6, H12, H18, H24, H36, H48, H60, and H72). Rescue doses of nalbuphine were allowed on demand in case of persistent pain between 2 scheduled analgesic injections. No patient asked for such additional injections.

### STATISTICAL ANALYSIS

The median rates of each parameter were determined at every hour of assessment. The hour corresponding to the highest median score could then be determined for all parameters. The earlier hour corresponding to a painless median level was also established. To prove that the differences between the scores indicated by patients were significant, depending on the postoperative hour of assessment, the nonparametric Friedman test was used. A value of  $P \leq .05$  using the  $\chi^2$  test was considered significant. The collected data were also plotted as a function of time for each patient; this allowed individual comparisons between rates of POP and other criteria in each patient. For these comparisons, nonparametric Spearman correlation coefficients were used.<sup>17</sup> Correlation was considered significant when  $P < .05$ .

efficacious method of relieving pain after laryngeal surgery, we prescribed the current analgesic regimen used in our department, which consisted of analgesic injections at fixed hours, with the possibility of rescue doses on demand. This analgesic course had been established on the basis that analgesic administrations at fixed hours led to better pain control than so-called "on demand" analgesia,<sup>12</sup> that is, analgesic administrations once the patient in pain has called the nurse. The other major goal of this study was to test the real efficacy of this analgesic regimen. Anxiety was rated not only to understand the degree of anxiety after laryngeal surgery for cancer, but also to look for any correlation between anxiety and POP. Actually, a correlation between these 2 criteria would certainly suggest a change in our approach to management of POP after this type of surgery. A minor goal was to test whether POP could indirectly be assessed by objective, easily measured criteria, such as heart and respiratory rates or mean blood pressure, since pain can produce alterations of cardiovascular parameters<sup>13,14</sup> and induce changes in respiratory function.<sup>15,16</sup>

## RESULTS

All measurements were able to be carried out as scheduled for every patient. None of them found the assessments tiresome. Despite alleged pain at some measurement times, no patient asked for supplementary doses of analgesics.

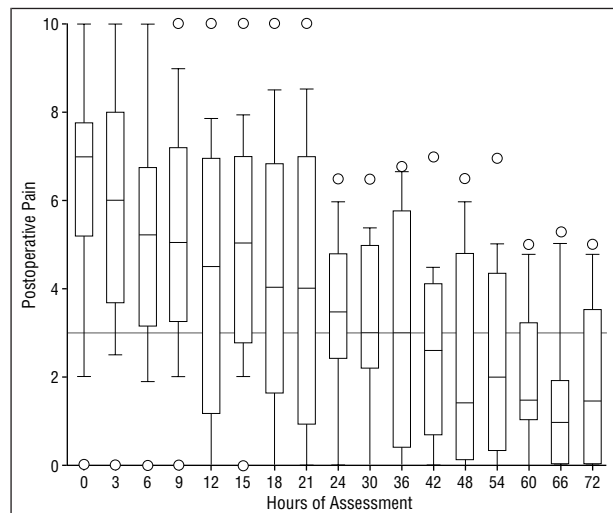
### PAIN

The scores of POP appeared to decrease with time. This decrease was significant according to the nonparametric Friedman test ( $\chi^2_{16} = 104.93; P \leq .001$ ). The median rate of POP at each time of assessment is illustrated in **Figure 1**. The highest median score (7) was found at H0, and a value of 3 or less was not obtained before H30. The changes of POP rates were unpredictable over the whole period of assessment. Numerous individual variations were reported, each curve showing unpredictable peaks of variable intensity of pain that broke the monotony of decrease.

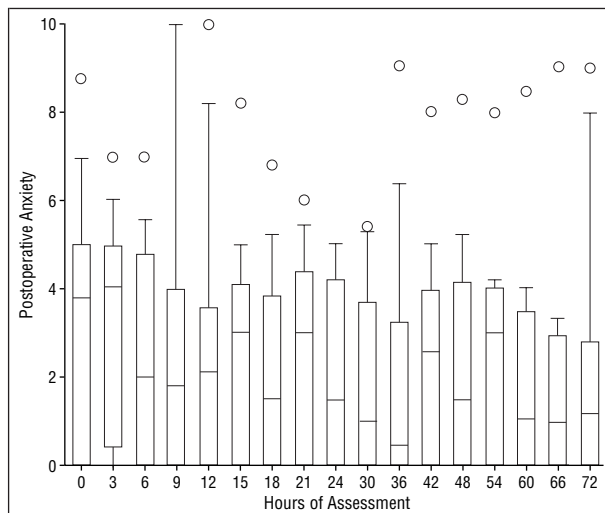
## Patient Characteristics\*

	Patient No.									
	1	2	3	4	5	6	7	8	9	10
Age, y	55	55	71	73	64	61	71	73	40	38
Previous head and neck cancer treatment	None	None	None	None	None	None	Radiation therapy	None	None	None
Tumor staging	T3 N0 M0	T3 N2b M0	T3 N0 M0	T2 N1 M0	T3 N2a M0	T3 N2c M0	T3 N0 M0	T2 N0 M0	T3 N1 M0	T3 N2b M0
Type of surgery	TL and VP	TPL	TL	HSG	TPL	TPL	TL and VP	HSG	TPL	TPL
Neck dissections	FND	FND	FND	FND and RND	FND and RND	FND and RND	FND	FND	FND	FND and RND

\*STL indicates subtotal laryngectomy; FND, functional neck dissection; TL, total laryngectomy; VP, voice prosthesis; TPL, total laryngectomy with partial pharyngotomy; HSG, horizontal supraglottic laryngectomy; and RND, radical neck dissection.



**Figure 1.** Box plots of postoperative pain assessed using a visual analog scale. Horizontal lines within the boxes indicate the median, and limits of the boxes, the quartiles. The most extreme score is represented by an open circle at each hour of assessment. Maximum median rate is seen at H0. A painless median level is not obtained before H30. The horizontal dashed line indicates the significant threshold of pain (3).



**Figure 2.** Box plots of postoperative anxiety assessed using a visual analog scale. Horizontal lines within the boxes indicate the median, and limits of the boxes, the quartiles. The most extreme score is represented by an open circle at each hour of assessment. Note that anxiety median rates were never high (4). However, anxiety can be high in a few cases, as indicated by the highest values.

## ANXIETY

The highest median rate of anxiety (**Figure 2**) was found at H3 and was not high (4). Three patients always indicated scores equal to 0 (patients 3, 4, and 8). No significant difference was shown between each hour of assessment ( $\chi^2_{16} = 15.56$ ;  $P = .48$ ). By contrast, significant differences of scores of anxiety were noted between patients ( $\chi^2_{14} = 150.41$ ;  $P < .001$ ). Significant correlations between scores of POP and anxiety were found in 9 patients. The analysis of each case, when plotting anxiety scores as a function of time, provided different and variable curves as unpredictable as those for pain measurements.

## MEAN BLOOD PRESSURE

The rates of MBP were almost stable, with only a minor tendency to decrease with time. The averages ( $\pm$ SD) of MBP varied from  $98.5 \pm 13.4$  mm Hg (H0) to  $82.8 \pm 9.0$  mm Hg (H72). The highest values were collected at H0. No significant difference was shown between the scores of this parameter when the hours of assessment were compared using the Friedman test ( $\chi^2_{16} = 23.95$ ;  $P = .09$ ). No signifi-

cant correlation was found between POP and MBP variations (data not shown).

## RESPIRATORY AND HEART RATES

The courses of these 2 parameters looked almost parallel, with a tendency to increase slightly with time. The averages ( $\pm$ SD) of respiratory rate varied from  $17/\text{min} \pm 3/\text{min}$  (H0) to  $18/\text{min} \pm 6/\text{min}$  (H72), with a maximum of  $20/\text{min} \pm 3/\text{min}$  (H60). Averages ( $\pm$ SD) of heart rate varied from  $75/\text{min} \pm 13/\text{min}$  (H0) to  $86/\text{min} \pm 11/\text{min}$  (H72), with a maximum value reached at H60 ( $86/\text{min} \pm 18/\text{min}$ ) and H72 ( $86/\text{min} \pm 11/\text{min}$ ). The Friedman test did not show any significant difference across the hours of assessment for heart rate ( $\chi^2_{16} = 24.58$ ;  $P = .08$ ) or for respiratory rate ( $\chi^2_{16} = 24.85$ ;  $P = .07$ ). We did not find any significant correlation between POP and these criteria (data not shown).

## COMMENT

In head and neck departments, POP has already been evaluated, notably after tonsillectomy.<sup>4-6</sup> But, to our knowledge, it has not been assessed after laryngeal

11	12	13	14	15
74	67	57	48	56
None	STL and FND	None	None	None
T3 NO MO TL FND	T3 NO MO TL and VP None	T3 NO MO TL and VP FND	T3 N2c MO TL and VP FND	T3 N1 MO TPL FND

surgery for cancer. The main goal of this clinical investigation was to obtain an outline of the intensity of pain in the early postoperative period after laryngeal surgery for cancer, so that the management of pain after this type of surgery could be improved if necessary. The analgesic regimen used was supposed to block pain as soon as possible; thus, low levels of pain intensity were expected.

The first 15 patients unfortunately alleged unacceptable levels of pain. The study was then stopped for evident ethical reasons. Consequently, we acknowledge that the results presented herein, issuing from a small sample, may not allow for the detection of significant relationships due to a type II error. However, this report, proving first that the assessment of POP is easily feasible after laryngeal surgery and second that POP can be high in these patients, can be of interest to clinicians who currently are in charge of patients undergoing surgery for laryngeal cancer.

Subjective criteria such as pain and anxiety involve complex features. It is well known, for example, that the way pain is felt depends on multiple criteria, including personal experience and previous diseases, in addition to cultural parameters. That is why, to characterize pain as precisely as possible, several questionnaires have been established, such as that of McGill (for an overview of these questionnaires, see Melzack and Katz).<sup>18</sup> The validity of VASs in pain assessment has been clearly proven,<sup>19</sup> as well as in the assessment of pain relief.<sup>20</sup> Anxiety can also be assessed by this method.<sup>11</sup> In pain evaluation, scores lower than 3 are usually not considered significant.<sup>21</sup> This tool allowed us to assess the 3 subjective criteria as early as the first hours following recovery in patients unable to speak. In this investigation, the main advantage of the VAS was that it is minimally intrusive and simple to use.<sup>18</sup> One could argue that pain and anxiety have several dimensions that make, for instance, a toothache different from the pain of a broken leg, even when their intensities are identical.<sup>18</sup> But assessing the multiple dimensions of pain and anxiety requires the use of questionnaires (eg, the McGill questionnaire for pain<sup>18</sup> and the State-Trait Anxiety Inventory for anxiety<sup>22</sup>) that do not have the ease and brevity of administration and scoring of VASs,<sup>18</sup> properties allowing the evaluation of these subjective parameters in the early postoperative period. Another advantage of VAS is its ratio property that is not found in other noninvasive and simple scales, such as verbal ones.<sup>18</sup>

The collected scores were analyzed in each individual to avoid false correlations between the scores given by 2 different patients. This allowed us to infer some clinical conclusions even though the origins of the patients as well as their previous experience of illness and pain could not be controlled for.

The maximum median value of pain measured at H0 revealed that laryngeal surgery can produce high levels of pain. Intraoperative analgesia using the potent opioid fentanyl citrate was apparently satisfactory at this point, as appreciated by the measurements of hemodynamic parameters during anesthesia.<sup>13,14</sup> However, decreasing the doses of fentanyl at the end of the surgical procedure was needed to avoid respiratory depression<sup>23</sup> and to prevent a possible interaction with nalbuphine, which has opioid antagonist properties.<sup>24</sup> Efforts to obtain lower scores of POP should be focused on the intraoperative period, to block pain before recovery, or furthermore, to prevent its occurrence. Preemptive analgesia, ie, analgesic administration (most often by means of local injections) before any surgical incision, has been assessed in head and neck surgery,<sup>4,6,25</sup> but, to our knowledge, still remains to be tested in laryngeal surgery. Reduction in POP can also be obtained, of course, by using efficient analgesic drugs after surgery. The effectiveness of the analgesics used in this investigation seemed to be confirmed by the close relationship between the scores of pain and pain relief. However, the timing of their course was inadequate: the peaks of pain observed in several patients suggested a too-short duration of analgesia in these patients. This emphasizes the need to perform individual analgesic titration. The use of continuous infusions and/or patient-controlled analgesia systems could solve this problem, but this has not been tested after laryngeal surgery. Although rescue doses were allowed for ethical reasons, they were surprisingly not demanded by patients. Hypothetically, it seems likely that, in the first 24 postoperative hours, patients did not expect an immediate relief of pain, and thus received the next scheduled analgesic injection 3 hours later before deciding to call for a supplementary dose of analgesic. In the following days, levels of pain were not so high, which may explain why the patients did not feel the need for rescue doses. However, this suggestion does not explain why the patients who indicated high scores of pain did not call the nurse in the second or third postoperative day. Therefore, it seems more likely that patients simply did not dare to call for supplementary analgesics.

The scores of anxiety collected in our sample seem to indicate that patients were only moderately anxious. Three patients even indicated a 0 score at any time of assessment. This fact was surprising because patients were expected to feel anxious after losing their ability to communicate. Two facts may explain the low rates of anxiety: first, all patients knew they were operated on for cancer and felt relieved of their dreaded illness after surgery; and second, the investigation itself brought about multiple opportunities for the patients to communicate with the nursing staff, the end result being a confident nurse-patient relationship. The lack of marked anxiety in most cases may explain the lack of correlation between POP and anxiety noted in 6 patients. However, in some cases

anxiety can be high (eg, the highest values in Figure 2) and should be treated effectively. These case reports of high anxiety, even if there were few, prove that the assessment of anxiety can be as useful as that of pain, even though these 2 parameters were not found to correlate.

In conclusion, it appears that after laryngeal surgery POP can be high, which justifies its systematic assessment and efficient reduction. In contrast, it is likely that anxiety is only moderate. Since the collected objective parameters showed postoperative changes independent from pain, their evaluation does not seem helpful in the assessment of POP. The first hours following the recovery represent a key period when pain can be maximal. This leads us to focus on techniques of preemptive analgesia. The unpredictable individual variations of pain pointed out the inadequacy of analgesic injections at fixed hours. Finally, after laryngeal surgery for cancer, pain could be lowered by means of preemptive analgesia together with individually adapted analgesic courses, using for instance patient-controlled analgesia systems like those in other surgical specialties.<sup>3,11,21</sup> However, these hypotheses remain to be proven by further clinical studies.

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