Objectives: To evaluate the adequacy of as-needed (prn) dosing of narcotics during the acute postoperative period following laryngectomy and to evaluate the role of nurses’ interpretation and implementation of narcotic orders in postoperative pain management.

Study Design: A retrospective review of the medical records of 37 patients who underwent laryngectomy at the University of Oklahoma. The postoperative care was standardized through a clinical pathway to provide a uniform level of care.

Methods: The parameters reviewed include (1) the type and dose of analgesic prescribed, (2) the quantity and frequency of analgesic administered to each patient, and (3) the adequacy of the initial pain-control prescription.

Results: All physician orders for narcotics were at or above the minimum dosing guidelines; 68% met a recommended adequate postoperative prescription for moderate pain. However, none of the patients actually received the intended dose during a 24-hour period while hospitalized. Physicians were contacted about 13 patients (35%) because of inadequate pain relief, but only 8 patients (22%) had their narcotic dose increased appropriately. Patients were dosed below the minimum prescribed dose 19 times (2.8%), and in 24 instances (3.6%) the backup analgesic, designated as “prn breakthrough pain,” was given as the primary analgesic.

Conclusions: As-needed dosing of analgesia resulted in suboptimal pain control for at least 35% of patients undergoing laryngectomy. Inadequate prescription and variable implementation of prn orders contributed to this.


PAIN IS one of the most feared consequences of cancer, and as many as 72% of patients who die of cancer die with pain.\(^1\) Many patients with head and neck cancer do not present until they develop intolerable pain.\(^2\) The treatment of head and neck cancer often includes ablative surgery, which can be a source of both acute and chronic pain. In a study of 93 patients with head and neck cancer, Chaplin and Morton\(^3\) found that 48% of the patients had pain at the time of diagnosis. Following surgery, 25% of these patients had chronic pain after 12 months, and 26% after 24 months. Adequate pain control is an important factor in preserving quality of life for patients with head and neck cancer, particularly during the acute treatment phase.

Despite the association of pain with cancer, pain management is not emphasized appropriately in medical training and is infrequently discussed in cancer literature. As little as 0.1% of the cancer literature addresses the diagnosis of pain or its management.\(^1\) As a result, shortfalls in the administration of analgesics are common. In 1973, Marks and Sachar\(^4\) analyzed the pain management of 37 patients admitted to a medical ward. They reported that despite physician orders for narcotics, 32% of patients suffered severe distress, 41% moderate distress, and 27% minimal distress from pain. They found that the analgesic amount actually administered was “less-than-optimal dosing” in 65% of their study population, concluding that health care professionals undertreat pain. One criticism of this study is the sample population: most of the patients were admitted for chest pain, and none were recovering from surgery. No study to date has evaluated the adequacy of acute pain management in patients recovering from ablative surgery for head and neck cancer.

Frenette\(^5\) suggests that 30% to 70% of patients who have undergone major surgery experience severe postoperative pain. The main reason cited for insufficient postoperative pain control is inadequate ap-
MATERIALS AND METHODS

A retrospective review was performed of the medical records of patients who underwent either a total laryngectomy or laryngopharyngectomy at the University of Oklahoma Health Sciences Center, Oklahoma City, from February 1, 1998, to December 30, 2000. Beginning in February 1998, all patients undergoing a laryngectomy at the University of Oklahoma Health Sciences Center have been enrolled in a clinical pathway designed to standardize postoperative care. Uniform levels of postoperative nursing care, patient education, and rehabilitation implemented in the pathway provide the population with similar surgical intervention, postoperative pain management, and hospital stay. Since one goal of the pathway is to provide teaching to allow discharge on postoperative day 7, the medical records were reviewed only through the seventh postoperative day.

Physician orders were reviewed to determine the narcotics prescribed, dosing guidelines, and any changes made because of inadequate pain control. Nurses’ notes were reviewed to determine the analgesic doses administered to each patient and the frequency of dosing. Prescribed and administered doses were compared between hospital locations (intensive care unit [ICU] vs regular hospital floor). Adequacy of pain control was assessed using 2 end points: (1) were analgesic doses increased during the postoperative stay? and (2) were physicians called because of inadequate pain control?

On completion of data collection, all analgesic doses were standardized to equivalent doses of parenteral morphine sulfate (Table 1). Descriptive statistics were used to analyze the results. Paired t tests were used to evaluate differences between the analgesic amounts prescribed and the amounts administered.

Table 1. Equianalgesic Doses Adapted From Acute Pain Management in Adults: Operative Procedures

<table>
<thead>
<tr>
<th>Drug</th>
<th>Equivalent Doses, mg¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine sulfate</td>
<td>10 IV</td>
</tr>
<tr>
<td>Hydrocodone, 7.5 mg</td>
<td>30 PO</td>
</tr>
<tr>
<td>Oxycodone, 5 mg</td>
<td>30 PO</td>
</tr>
<tr>
<td>Codeine</td>
<td>130 PO</td>
</tr>
<tr>
<td>Meperidine</td>
<td>300 PO</td>
</tr>
<tr>
<td>Morphine sulfate elixir</td>
<td>30 PO</td>
</tr>
</tbody>
</table>

¹IV indicates intravenous administration; PO, by mouth.

RESULTS

A total of 44 patients were enrolled in the laryngectomy clinical pathway. Four patients were excluded from the study because of variations in the extent of the ablative surgery: 3 underwent a total or near-total glossectomy, and 1 had a hemilyrngectomy. Also excluded were 2 patients whose medical records were not available and 1 patient with chronic paranoid schizophrenia who required treatment with large doses of antipsychotic agents in the perioperative period. Thus, the study cohort consisted of 37 patients, 34 men and 3 women. The mean age was 59 years, with a range from 37 to 79 years.

The primary tumor sites were supraglottic (65%), glottic (22%), base of the tongue (8%), and supraglottic (5%). Thirty-four patients underwent a total laryngectomy, and 3 underwent a laryngopharyngectomy. Neck dissections were performed in 35 patients (95%). Eight patients (22%) had reconstruction of the pharynx with a pectoralis flap and 1 (3%) with a free radial forearm flap. Six patients (16%) had complications: 5 fistulas and 1 hematoma. The median hospital stay was 8 days (mean, 9 days), with the shortest stay being 4 days.

The most commonly prescribed analgesic during the period of this study was morphine sulfate, which accounted for 87% of hospital days and was the only analgesic given in 39% of hospital days. Combined narcotic and acetaminophen preparations containing hydrocodone, oxycodone, and codeine were also prescribed. Hydrocodone was the most frequently prescribed drug and was ordered in 30% of total hospital days and was the sole analgesic in 10% of hospital days (Table 2). In addition to narcotics, 26 patients (70%) were prescribed an anxiolytic during their hospital stay, 22 on a prn basis and 4 as scheduled medicines. Eleven patients (30%) received at least 1 anxiolytic dose.

In the ICU, the average minimum daily order for analgesia was 29.9 mg/d of morphine sulfate, but the average daily dose administered was 20.0 mg/d. The difference between the minimum amount prescribed to ICU patients and the mean dose received was statistically sig-
significant ($P = .005$). On the regular hospital floor, the average minimum daily order of morphine sulfate was 31.4 mg/d, but the average amount received was only 11.5 mg/d ($P = .001$). The mean dose administered in the ICU (20.0 mg/d) was greater than the mean dose administered on the regular hospital floor (11.5 mg/d) ($P < .001$). The mean maximum dose available differed also between hospital wards: 79.08 mg/d in the ICU; 67.95 mg/d on the regular floor ($P = .01$).

For the purpose of the analysis, 12 mg/d was selected as the minimum recommended dose of morphine sulfate (this is the lowest dose recommended by the Physicians’ Desk Reference for a 70-kg patientootnote{Physicians’ Desk Reference}). This dose was prescribed for all the patients in the study and on all hospital days. The US Department of Health and Human Services (USDHHS) recommendations were used to select a dose considered adequate for moderate postoperative pain (60 mg/d).ootnote{Physicians’ Desk Reference} All patients studied received less than this recommended dose, even though this dose was prescribed during 68.6% of hospital days. The maximum daily dose received by any patient in 1 day was 50 mg. The mean dose received was 12.9 mg/d but differed between hospital wards. Patients in the ICU received an average of 20.0 mg/d, while those on the floor averaged 11.5 mg/d. When the patient’s weight was factored in, the adequate dose for moderate postoperative pain (0.857 mg/kg per day) was prescribed in 61.7% of physicians’ orders. The mean dose received per day was 0.181 mg/kg, with the maximum being 0.800 mg/kg. Again, there was a difference between doses administered between hospital wards (ICU, 0.277 mg/kg per day; regular floor, 0.162 mg/kg per day), which was statistically significant ($P = .002$). The distribution of the amount received per hospital day was fairly uniform except for a large group with almost no narcotic (Figure).

While all patients were prescribed the minimum Physicians’ Desk Reference recommended dose,ootnote{Physicians’ Desk Reference} analgesic prescriptions for less than the USDHHS recommended 0.857 mg/kg per day were ordered during 38.3% of all hospital days, which affected 57% of the patients for at least 1 day during the first 7 postoperative days. As one might expect, this was more frequent on the floor (48.6%) than in the ICU (29.7%). The average amount of drug administered to patients was 18% of the maximum dose available or 41% of the minimum value prescribed. Interestingly, physicians were contacted regarding additional pain needs for 13 patients (35%), but only 8 patients (22%) received an order to increase or augment the narcotic dose.

**Comment**

Despite the effort to ensure adequate pain control by federal and world health care organizations,ootnote{Physicians’ Desk Reference} pain control continues to receive little attention in the literature and in medical training.ootnote{Physicians’ Desk Reference} Inadequate prescribing patterns persist and may adversely affect patients in the hospital. In our study, 38.3% of physician orders prescribed analgesic levels below the USDHHS recommended dose for moderate postoperative pain. This could have resulted from inadequate knowledge of appropriate narcotic dosages or from reluctance to aggressively treat postoperative pain. Many factors have been suggested as explanations for physician reluctance to treat pain aggressively. These include concerns about adverse effects, the potential for addiction, lack of knowledge of appropriate dosing, and inadequate use of appropriate therapies.ootnote{Physicians’ Desk Reference} Physician perception of increased amounts of pain in the immediate postoperative period may explain higher narcotic doses available in the ICU than on the regular hospital floor.

It is possible that the level of pain experienced by patients after undergoing laryngectomy was controlled by lower than the USDHHS recommended narcotic doses. In this series, we attempted to measure the adequacy of narcotic prescriptions by physician contact for additional pain medicine or increase in the amount available. Thirteen patients (35%) had inadequate pain control by this measure. This finding must be interpreted cautiously because it may not reflect patient satisfaction with the regimen or the nature of the complaint. Since only 8 of these 13 patients had additional pain medication ordered, it is possible that there were other issues that prompted the call as well. For a true assessment of adequacy of pain control, a prospective assessment of pain levels must be performed.

Prescribing prn analgesia introduces potential error and bias into pain management. In this review, significant differences were found between physician analgesic orders and nurse administration of analgesics in the ICU and on the floor. One possible explanation is that

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### Table 2. Principal Analgesics Prescribed for Postoperative Pain and Their Respective Frequencies

<table>
<thead>
<tr>
<th>Analgesic</th>
<th>No. of Hospital Days Prescribed</th>
<th>% of Prescriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine sulfate</td>
<td>111</td>
<td>38.68</td>
</tr>
<tr>
<td>Hydrocodone</td>
<td>85</td>
<td>29.62</td>
</tr>
<tr>
<td>Hydrocodone alone</td>
<td>28</td>
<td>(9.76)</td>
</tr>
<tr>
<td>Hydrocodone with morphine</td>
<td>57</td>
<td>(19.86)</td>
</tr>
<tr>
<td>sulfate as “breakthrough”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morphine sulfate and hydrocodone together</td>
<td>73</td>
<td>25.44</td>
</tr>
<tr>
<td>Morphine sulfate and oxycodone together</td>
<td>10</td>
<td>3.48</td>
</tr>
<tr>
<td>Codeine</td>
<td>6</td>
<td>2.09</td>
</tr>
<tr>
<td>Meperidine</td>
<td>2</td>
<td>0.70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>287</strong></td>
<td><strong>100.01</strong>*</td>
</tr>
</tbody>
</table>

*Percentage total exceeds 100 because of rounding.

The daily dose of narcotic (morphine sulfate equivalent) administered over the number of hospital days in this study. The limit at 60 mg/d represents the US Department of Health and Human Services recommendation for a dose adequate to treat moderate postsurgical pain. The limit at 12 mg/d is the lowest dose recommended by the Physicians’ Desk Reference for a 70-kg patient.  

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the patients did not request pain medication as often as it was available. A second explanation is that when narcotics were administered, nurses underestimated the severity of postoperative pain, and therefore minimal amounts were given. This bias can affect the amount or frequency of nurse-administered prn analgesics more than any other dosing method or route. Interestingly, nurses who have personally experienced postoperative pain are inclined to more freely administer analgesia, while nurses with more clinical experience administer less. The impact of a nurse's interpretation of orders was clearly demonstrated in 19 instances (2.8%) where the amount given to a patient was less than the minimum prescribed dose. The differences seen between the ICU and the floor in our study may reflect nursing bias in the estimation of the degree of pain, actual differences in the degree of pain (which may have lessened with time), variability in comfort level of different nursing units with administration of narcotics, or nursing availability for assessment of pain and administration of analgesics.

The route of administration did not seem to affect narcotic administration. On 83 (29%) of 287 hospital days, enteral and parenteral preparations were ordered. Despite both being available, during 21 (25%) of these days no narcotic analgesic was administered, and in most instances there was a preferred drug: only 1 of the 2 medicines was administered to patients on 43 days (77%). In 24 doses (3.6%), the analgesic designated as "prn breakthrough pain" or "prn severe pain" was given as the primary analgesic.

To overcome these pain management shortcomings, several measures should be taken: (1) educate physicians on adequate dosing of narcotics in the postoperative setting; (2) educate nursing staff; (3) prescribe a single dose rather than a range; (4) use scheduled narcotic dosing; and/or (5) use different methods of delivery including patient-controlled anesthesia. A prospective trial comparing patient-controlled anesthesia with nurse-administered prn analgesics in the management of pain is currently under way to further study this issue.

In conclusion, in our group of postlaryngectomy patients, physicians' narcotic orders always met minimum dosing guidelines. However, 38.3% of orders failed to meet USDHHS recommended doses for treating moderate postoperative pain. Implementation of prn narcotic orders by nurses varied significantly between the ICU and the floor, and all patients received less than the USDHHS recommended doses. In 35% of cases, physicians were contacted because of inadequate pain control. Both the range available and the bias of the administering nurses may have contributed to this occurrence.

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REFERENCES