BLIND INSERTION OF FEEDING TUBES IN INTENSIVE CARE UNITS: A NATIONAL SURVEY

By Norma A. Metheny, RN, PhD, Barbara J. Stewart, PhD, and Andrew C. Mills, RN, PhD

Background Although most critically ill patients experience at least 1 blind insertion of a feeding tube during their stay in an intensive care unit, little is known about the types of health care personnel who perform these insertions or about methods used to determine proper positioning of the tubes.

Objectives To describe results from a national survey of critical care nurses about feeding tube practices in their adult intensive care units. The questions asked included who performs blind insertions of feeding tubes and what methods are used to determine if the tubes are properly positioned.

Methods Data were collected from members of the American Association of Critical-Care Nurses via pencil-and-paper and online surveys. Results from both forms were combined for data analysis and were compared with practice recommendations of national-level organizations.

Results A total of 2298 responses were obtained. Physicians perform more blind insertions of styleted feeding tubes than do nurses; in contrast, nurses place more nonstyleted tubes. Radiographic confirmation of correct position is mandated more often for blindly inserted styleted tubes (92.3%) than for nonstyleted tubes (57.5%). The 3 most commonly used bedside methods to determine tube location are auscultation for air injected via the tube, appearance of feeding tube aspirate, and observation for indications of respiratory distress.

Conclusions Recommendations from multiple national-level organizations to obtain radiographic confirmation that each blindly inserted feeding tube is correctly positioned before the first use of the tube are not adequately implemented. Auscultation is widely used despite recommendations to the contrary. (American Journal of Critical Care. 2012;21:352-360)
Most critically ill patients experience at least 1 blind insertion of a feeding tube during their stay in an intensive care unit (ICU). However, little is known about the types of health care personnel who perform these insertions or about methods used to determine if the tubes are properly positioned. In this article, we describe results from a survey of critical care nurses about feeding tube practices in the nurses’ ICUs. Results from the survey are compared with practice recommendations from national-level organizations.

Background

Who Can Perform Blind Insertions of Feeding Tubes?

No consistent rules exist about who can (and cannot) perform blind insertions of feeding tubes in intensive care areas. Practice acts vary from state to state, and individual hospitals often impose their own rules. For example, some hospitals allow only physicians to blindly insert styleted tubes, whereas other hospitals rely on registered nurses to perform blind insertions of both styleted and nonstyleted feeding tubes.

Testing Placement of Feeding Tubes

Radiography. Agreement is widespread that the best evidence of tube placement is a properly interpreted radiograph that shows the entire course of the tube.1-8 Table 1 provides a summary of guidelines for the radiographic confirmation of blindly inserted feeding tubes.

Bedside Techniques. The American Association of Critical-Care Nurses (AACN) practice alert3 on verifying the placement of feeding tubes recommends that a variety of bedside techniques be used to estimate the location of a tube during the insertion procedure (before obtaining a confirmatory radiograph) and again every 4 hours while the tube is in use.

Capnography: Two sets of guidelines2,3 recommend the use of capnography, if available, during tube insertions as a precursor to radiography. Although capnography is helpful in predicting tube location,10,11 it is not sufficiently sensitive and specific to preclude a confirmatory radiograph before the initial use of a feeding tube.12,13

Auscultation: All of the guidelines listed in Table 2 caution against use of auscultation to determine tube location. Several studies14-23 have shown that listening for air over the epigastrium while insufflating air via the tube is ineffective in distinguishing between placement in the respiratory tract, esophagus, stomach, and small bowel. In addition, numerous case reports17-25 describe situations in which results of auscultation did not indicate respiratory placement of tubes, often resulting in catastrophic outcomes when feedings or medications were administered via the tubes.

pH of Aspirates: Two sets of guidelines2,3 (Table 3) recommend testing the pH of feeding tube aspirates as a precursor to (but not a substitute for) radiographic confirmation of tube location. Proper use of the pH method can usually reduce the required number of confirmatory radiographs to 1. A third set of guidelines,9 which were developed in the United Kingdom, recommend the pH method as the first-line test method, with radiographic confirmation used only when pH findings are inconclusive.

Appearance of Aspirates: Agreement is widespread that the appearance of feeding tube aspirates is inadequate as the sole method to distinguish between gastric and respiratory placement of the tube.16-20,24-30 Although 1 set of guidelines2 recommends against using the appearance of aspirates in any form, another set3 recommends observing the appearance of aspirates as an ancillary method to estimate tube position before radiograph is obtained and during feedings if the feedings are interrupted for more than a few hours. Two sets of guidelines2,3 recommend using the appearance of aspirates in conjunction with pH to determine when a feeding tube has been manually advanced from the stomach into the small bowel.
### Table 1
Summary of recommendations on radiographic confirmation of blindly inserted feeding tubes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itkin et al&lt;sup&gt;1&lt;/sup&gt;</td>
<td>After blind insertion of a nasogastric or orogastric tube, every patient should undergo radiography to confirm proper position of the tube before feeding is started.</td>
</tr>
<tr>
<td>Bankhead et al&lt;sup&gt;2&lt;/sup&gt;</td>
<td>For adults, obtain radiographic confirmation that any blindly placed tube (small- or large-bore) is properly positioned before initial use of the tube for administering feedings and medications.</td>
</tr>
<tr>
<td>American Association of Critical-Care Nurses&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Obtain radiographic confirmation of correct placement of any blindly inserted tube before initial use of the tube for administration of feedings or medications. The radiograph should show the entire course of the feeding tube in the gastrointestinal tract and should be examined by a radiologist to avoid errors in interpretation.</td>
</tr>
<tr>
<td>National Patient Safety Agency&lt;sup&gt;9&lt;/sup&gt;</td>
<td>Radiography is used only as a second-line test when no aspirate can be obtained or pH indicator paper has not confirmed the position of the nasogastric tube. The radiographer takes responsibility to ensure that the nasogastric tube can be clearly seen on the radiograph used to confirm the position of the tube.</td>
</tr>
</tbody>
</table>

### Table 2
Summary of recommendations on use of the auscultatory method to determine the location of feeding tubes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itkin et al&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Tubes in inappropriate locations (eg, lung, pleural cavity, esophagus) may be mistakenly deemed as being properly positioned when bedside auscultatory techniques are used.</td>
</tr>
<tr>
<td>Bankhead et al&lt;sup&gt;2&lt;/sup&gt;</td>
<td>In adult patients, do not rely on the auscultatory method to differentiate between gastric and respiratory placement or between gastric and small-bowel placement.</td>
</tr>
<tr>
<td>American Association of Critical-Care Nurses&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Recognize that the auscultatory (air bolus) method is unreliable.</td>
</tr>
<tr>
<td>National Patient Safety Agency&lt;sup&gt;9&lt;/sup&gt;</td>
<td>The “whoosh” test is never used to confirm the position of nasogastric tubes because the method is unreliable.</td>
</tr>
</tbody>
</table>

### Table 3
Summary of recommendations on use of the pH method to determine the location of feeding tubes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Association of Critical-Care Nurses&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Measure pH of aspirate from the tube, if pH strips are available, during the insertion procedure; however, this method does not preclude the need for a confirmatory radiograph to distinguish between gastric and respiratory placement.</td>
</tr>
<tr>
<td>Bankhead et al&lt;sup&gt;2&lt;/sup&gt;</td>
<td>When attempting to insert a feeding tube into the small bowel, observe for a change in the pH of aspirates as the tube progresses from the stomach into the small bowel; use this finding to determine when a radiograph is likely to confirm placement in the small bowel.</td>
</tr>
<tr>
<td>National Patient Safety Agency&lt;sup&gt;9&lt;/sup&gt;</td>
<td>Nasogastric tubes are not flushed, and no liquid or feedings are introduced through a tube after initial placement until pH testing or radiography confirms that the tip of the tube is in the stomach. For determining correct placement of feeding tubes, pH testing is the first-line method. The safe range is 1 to 5.5.</td>
</tr>
</tbody>
</table>
Respiratory Distress: One set of guidelines recommends removal of the tube during insertion if coughing and dyspnea occur; the same set cautions that lack of these signs is not proof that the tube is properly positioned. For example, some patients have had no obvious indications of respiratory distress despite the presence of a tube in the respiratory tract.18,31

Other Methods: Two sets of guidelines advocate marking the exit site of a feeding tube at the time of the initial radiograph and then observing for a change in the external length of the tube during feedings. The same guidelines recommend monitoring for an abrupt change in aspirate volume to determine if a feeding tube may have drifted upward from the small bowel into the stomach or from the stomach into the esophagus and reviewing routine radiographic reports to determine if the reports refer to the position of the feeding tube. Some evidence indicates that these easy-to-use methods can be helpful for confirming the position of a feeding tube.

Methods

Research Questions

The research questions are given in the Sidebar.

Survey Methods

The study was approved by the appropriate institutional review board and carried out in accordance with the ethical standards set forth in the Helsinki Declaration of 1975. The survey methods have been reported previously.33 In summary, a pencil-and-paper survey was mailed to 1909 members of AACN who were certified as critical care nurses (CCRNAs) and who worked in adult ICUs in university-based medical centers. In addition, readers of the AACN Critical Care Newsletter (an electronic newsletter distributed to all AACN members each week) were asked to participate in the survey if they were registered nurses who worked in an adult intensive care area and had not already completed the mailed survey. The mailed survey consisted of 20 multiple-choice questions; the online survey contained the same 20 questions plus 2 questions about CCRN status and work setting (to be congruent with the paper-and-pencil survey). Only the 7 questions given in the Sidebar are addressed in this report. Responses to the mailed survey were received between August 9, 2010, and December 20, 2010; responses to the online survey were received between October 28, 2010, and January 3, 2011.33

Respondents

As indicated in a previous report,33 only 450 of the 1909 mailed surveys were returned; in contrast, 1848 nurses responded to the on-line survey. Among

Sidebar Research questions

1. Who in your intensive care unit (ICU) is allowed to insert STYLETED feeding tubes? (Please mark all that apply.)
   a. Registered nurses
   b. Advanced practice registered nurses
   c. Physicians/residents
   d. Physician’s assistants
   e. Licensed practical nurses

2. Who in your ICU is allowed to insert NONSTYLETED feeding tubes? (Please mark all that apply.)
   a. Registered nurses
   b. Advanced practice registered nurses
   c. Physicians/residents
   d. Physician’s assistants
   e. Licensed practical nurses

3. Does your ICU require a radiograph to confirm that a blindly inserted STYLETED feeding tube is properly positioned BEFORE it is used for the first time?
   a. Always
   b. Usually
   c. Only when ordered by a physician
   d. Rarely
   e. Never

4. Does your ICU require a radiograph to confirm that a new blindly inserted NONSTYLETED feeding tube is properly positioned BEFORE the first feeding is administered via the tube?
   a. Always
   b. Usually
   c. Only when ordered by a physician
   d. Rarely
   e. Never

5. If a radiograph is ordered to confirm tube placement, which of the following methods is advocated in your ICU to estimate tube location BEFORE the radiograph is obtained? (Please mark all that apply.)
   a. Capnography
   b. Injecting air through the tube and listening for a “whoosh” sound
   c. Measuring the pH of fluid withdrawn from the tube
   d. Observing the appearance of fluid withdrawn from the tube
   e. Observing the patient for signs of respiratory distress

6. If a radiograph is not ordered to confirm correct placement of a new blindly inserted tube, which of the following methods does your ICU advocate to determine tube location BEFORE feedings are started? (Please mark all that apply.)
   a. Capnography
   b. Injecting air through the tube and listening for a “whoosh” sound
   c. Measuring the pH of fluid withdrawn from the tube
   d. Observing the appearance of fluid withdrawn from the tube
   e. Observing the patient for signs of respiratory distress

7. Which of the following bedside methods are advocated in your ICU to confirm that a feeding tube has remained in correct position AFTER feedings have been started? (Please mark all that apply.)
   a. Marking the exit site of the tube and checking for a change in the external length of the tube
   b. Injecting air through the tube and listening for a “whoosh” sound
   c. Observing the appearance of aspirate from the feeding tube
   d. Observing for an abrupt change in volume of aspirate from the feeding tube
   e. Reviewing routine radiography reports to determine if the radiologist has also described feeding tube location

www.ajcconline.org
the combined 2298 respondents, 58.1% were certified by the AACN as CCRNs, 42.0% worked in a university-based medical center, and 22.3% worked in critical care units that had received a Beacon Award for Excellence (a designation offered by AACN to recognize high standards of achievement).

Data Analysis

Responses from paper-and-pencil surveys were combined with responses from the online surveys. As previously reported, combining the results from the 2 methods is supported by statistical analyses and by similar studies.34 Descriptive statistics (frequencies and percentages) were used to report the findings. The \( \chi^2 \) test was used to compare percentages according to certification status and work settings. Only results with \( P < .01 \) and differences in percentages greater than 5% are reported.

Results

Who Places Feeding Tubes

Overall, as shown in Figure 1, physicians perform more blind insertions of styleted feeding tubes than do registered nurses (74.5% vs 66.3%). In contrast, registered nurses perform more blind insertions of nonstyleted tubes than do physicians (93.2% vs 71%). Least likely to insert both types of tubes are physician assistants and licensed practical nurses.

Work settings have a strong association with the types of personnel who blindly insert styleted feeding tubes. For example, registered nurses in university-based medical centers are far less likely to perform blind insertions of styleted tubes than are registered nurses in non–university-based medical centers (58% vs 73%). In contrast, physicians in university-based medical centers are more likely to perform blind insertions than are physicians in non–university-based medical centers (81% vs 70%). Advanced practice nurses perform more blind insertions of styleted tubes in university-based medical centers than in non–university based centers (58% vs 45%) and in ICUs with Beacon Award status than in ICUs without this status (58% vs 48%).

Although a question about alternative methods for tube placement was not included in the surveys, 33 respondents wrote comments indicating that their ICUs do not perform blind insertions of feeding tubes.

Radiographic Confirmation

As shown in Figure 2, radiographic confirmation of correct tube placement is far more likely to be required for styleted feeding tubes (92.3%) than for nonstyleted tubes (57.5%). Nurses with CCRN status reported a higher use of radiography for blindly inserted styleted tubes than did nurses without this certification (95% vs 89%).

Bedside Methods Used Before Radiographic Verification

Figure 3 depicts the percentages of bedside placement testing methods used as precursors to obtaining a radiograph to confirm tube location. Before radiography, auscultation is by far the most frequently used bedside method (93%); next, in order, are observing for respiratory distress (68.4%) and observing the appearance of the tube aspirate (65.6%). Used infrequently are capnography (5.6%) and the pH method (11.4%). Nurses who work in...
university-based medical centers are more likely to use the pH method than are nurses who work in non–university-based medical centers (15% vs 9%) and less likely to observe appearance of the aspirate than are nurses in non–university-based medical centers (61% vs 69%).

Bedside Methods Used Instead of Radiography
Because most nurses reported that their ICUs favor the use of radiography to determine tube location, only 40.3% (n = 926) responded to the question about bedside methods used instead of radiography (Figure 4). In the absence of radiography (n = 926), nurses who work in university-based medical centers reported greater use of the pH method than did those who work in non–university-based centers (16% vs 8%).

Of the 926 respondents to this question, 161 reported that they use a single method to test placement in the absence of radiographic confirmation. Among these, 136 used auscultation; 11, the appearance of the tube aspirate; 7, aspirate pH; 4, respiratory distress; and 3, capnography.

Bedside Methods During Feedings
As shown in Figure 5, the most frequently reported method used to assess tube placement during feedings was auscultation (78.7%); next, in order were external length of the tube (65.9%), and appearance of the aspirate (64.6%). Nurses in ICUs with Beacon Award status are more likely to check the external length of the tube during feedings to detect tube movement than are nurses in ICUs without this status (72% vs 64%). Observing for changes in aspirate volume is performed less often by nurses with CCRN certification than by nurses without this certification (33% vs 40%). Nurses who work in university-based medical centers are less likely to rely on the auscultation method to determine tube location during feedings than are nurses in non–university-based medical centers (75% vs 81%). Finally, nurses who work in university-based medical centers are less likely to observe the appearance of aspirate during feedings to determine tube location than are nurses in non–university-based centers (60% vs 68%).

Discussion
Who Inserts Feeding Tubes?
Our findings show a wide variance in personnel who perform blind insertions of feeding tubes. Most likely, the preponderance of physicians (including those in training) in university-based medical centers is responsible for the reduced likelihood of having registered nurses blindly insert styleted tubes in
the finding that fewer styled tubes are inserted by advanced practice nurses in nonuniversity-based medical centers and in ICUs without Beacon Award status is not unlikely, because advanced practice nurses are less plentiful in these settings. Similarly, the lower number of tube insertions by physician assistants and licensed practical nurses is likely because these health care providers do not commonly work in intensive care areas.

**Radiography**

Reflective of recommendations in Table 1, most of the respondents (92.3%) reported that radiographic confirmation of correct placement is required before blindly inserted styled tubes are used for the first time. However, far less congruent with current guidelines is the relatively low use of radiographs (57.5%) to confirm the correct location of newly inserted nonstyled tubes. This finding is disturbing and indicates lack of awareness that nonstyled tubes can also be inadvertently positioned in the respiratory tract and even in the brain. In addition, of note, a tube with ports ending in the esophagus is malpositioned, because the position predisposes the patient to aspiration. For this reason, many institutions require radiographic confirmation that a nasogastric tube is actually in the stomach (vs the esophagus) before bowel-preparation solutions, tube feedings, or medications are administered via the tube.

**Bedside Methods**

As shown in Table 2, multiple guidelines caution against use of auscultation to determine tube placement because the rush of air is usually heard no matter where the tube is situated (esophagus, lung, stomach, or small bowel). Thus, the finding that this method is widely used by nurses in ICUs was disappointing. By far the most disturbing finding was the number of nurses (n = 136) who reported using auscultation as the sole method to test tube placement in the absence of a radiograph.

Evidence indicates that auscultation does not work, and multiple case reports have been published of patients who were catastrophically injured when feedings were administered into the respiratory tract because clinicians trusted the auscultation method. Consequently, understanding why the method remains in such wide use is difficult. The reported incidence of inadvertent placement of feeding tubes into the lungs ranges between 1.3% and 11%; when the large number of patients who require feeding tubes is considered, the magnitude of the problem is evident. Although clinicians may worry about the cost and time constraints associated with radiographic confirmation of blindly inserted tubes, the method is well worth the cost and effort because no bedside tests have the accuracy of a properly interpreted radiograph that shows the full course of a feeding tube.

Of note, capnography and pH testing are infrequently used in critical care settings. This finding could be due to the need for “extra” equipment or supplies when these methods are used. In addition to extra equipment, capnography and pH testing require additional effort on the part of nurses, a necessity that could add to the reasons why neither method is commonly used. Of note, laboratory restrictions may preclude nurses from testing the pH of feeding tube aspirates unless the nurses have participated in a program to demonstrate competency. Fortunately, nursing units can usually work with laboratory personnel to develop programs to demonstrate this competency.

Work setting had an effect on the use of the pH method. Perhaps nurses who practice in university-based medical centers, as well as nurses who practice in ICUs with Beacon Award status, are more familiar with recommendations to use aspirate pH as an ancillary method to determine tube position. Also, nurses in these settings might have been more willing to participate in the program necessary to demonstrate proficiency in pH testing.

The guidelines provide no clear consensus on the use of the appearance of an aspirate; further, the question on aspirate appearance included in the survey lacked sufficient clarity to determine how nurses actually use the method to determine tube placement (eg, trying to distinguish between gastric and respiratory placement and between gastric and small-bowel placement). Although nurses in university-based medical centers are less likely than those in non–university-based medical centers to rely on the appearance of the tube aspirate to determine tube placement, this method is widely used overall.

The finding that more than two-thirds of the respondents observe patients for respiratory distress during insertion of feeding tubes was not surprising. In addition to being based on common sense, this method does not require additional equipment to perform. Because monitoring the external length of
a feeding tube is easy, the finding that only two-thirds of the respondents reported using this method to determine if a tube has remained in its intended position during feedings was surprising. The finding that only about one-third of the respondents reported monitoring for a change in aspirate volume to determine placement during feedings suggests that most nurses are unaware of this recommendation (or remain uncertain about how the recommendation should be applied).

Limitations

Although the sample size (n = 2289) seems large, it is relatively small in relation to the number of critical care nurses overall. Further, the sample was limited to AACN members. As indicated earlier, less than one-fourth of the paper-and-pencil surveys were returned from the population of CCRNs who work in adult ICUs in university-based medical centers. This population had initially been targeted because we assumed that these nurses were most likely to adhere to current practice guidelines. To increase the sample size, we offered the identical survey (with 2 added questions about CCRN status and work setting) online to the entire population of AACN members working in adult ICUs. Thus, the online survey could include responses from either CCRNs or non-CCRN nurses as well as nurses who worked in university-based medical centers or non-university-based medical centers. Although statistical analyses suggested that pooling the results from both samples was appropriate, a remote possibility exists for differences according to the type of survey method (paper-and-pencil questionnaire vs online questionnaire). An even greater limitation was self-selection of respondents; as such, the results may not reflect the practice of nurses who chose not to respond to the survey.

Nursing Implications

The findings from this study indicate clear opportunities to improve practices related to the insertion of feeding tubes. The following considerations are important:

• Evidence-based, current information about testing the placement of feeding tubes should be emphasized in basic nursing education programs.
• In-service programs in hospitals should be provided at regular intervals to help nurses assimilate the most current evidence-based information on testing the placement of feeding tubes.
• Nurses should review current guidelines to develop evidence-based protocols for monitoring placement of feeding tubes. These protocols should be updated as new reliable information becomes available.

Radiography is well worth the cost, as no bedside tests approach its accuracy.

• A variety of bedside methods should be used during tube insertions to test placement, including capnography (if equipment is available), observing the patient for respiratory distress, and measuring the pH of feeding tube aspirates (if pH test strips are available and a cooperative agreement has been reached with the laboratory).
• The auscultatory method should not be relied on to predict tube location.1-3
• Radiographic confirmation of correct tube placement should be mandatory for any blindly inserted tube before initial use of the tube for administering feedings or medication.3 The radiograph should show the entire course of the feeding tube in the gastrointestinal tract and should be interpreted by a radiologist. Marking the exit site of the tube from the nose or mouth immediately after radiographic confirmation of correct position is helpful in subsequent monitoring of tube location.
• The location of a feeding tube should be monitored every 4 hours during feedings to ensure that the tube has not become malpositioned. One helpful method is observing for a change in the length of the external part of the feeding tube. Another is reviewing routine chest and abdominal radiographic reports to look for notations about tube location. Still another method is observing for an abrupt change in aspirate volume; for example, aspirate volume may increase substantially when a feeding tube has become dislocated from the small bowel into the stomach.3

Conclusions

Practices associated with blind insertions of feeding tubes are only partially based on current recommendations. The survey’s most positive finding was that more than 90% of the respondents reported that a radiograph is mandated before a blindly inserted styleted tube is used for the first time. The most negative findings were that less than 60% of the respondents reported that a radiograph is obtained before the initial use of a blindly inserted nonstyleted tube for feedings and that the auscultatory method is in widespread use despite warnings from national-level...
organizations that the method is ineffective. Clearly, greater effort is needed to improve compliance with current guidelines to increase patients’ safety.

FINANCIAL DISCLOSURES

None reported.

eLetters

Now that you’ve read the article, create or contribute to an online discussion on this topic. Visit www.aajcconline.org and click “Submit a response” in either the full-text or PDF view of the article.

REFERENCES


To purchase electronic or print reprints, contact The InnoVision Group, 101 Columbia, Aliso Viejo, CA 92656. Phone, (800) 899-1712 or (949) 362-2050 (ext 532); fax, (949) 362-2049; e-mail, reprints@aacn.org.
Blind Insertion of Feeding Tubes in Intensive Care Units: A National Survey
Norma A. Metheny, Barbara J. Stewart and Andrew C. Mills

Am J Crit Care 2012;21 352-360 10.4037/ajcc2012549
©2012 American Association of Critical-Care Nurses
Published online http://ajcc.aacnjournals.org/

Personal use only. For copyright permission information:
http://ajcc.aacnjournals.org/cgi/external_ref?link_type=PERMISSIONDIRECT

Subscription Information
http://ajcc.aacnjournals.org/subscriptions/

Information for authors
http://ajcc.aacnjournals.org/misc/ifora.xhtml

Submit a manuscript
http://www.editorialmanager.com/ajcc

Email alerts
http://ajcc.aacnjournals.org/subscriptions/etoc.xhtml