# Prevention of Neoplastic Seeding During Surgery:

## An Investigation into OR Protocols and Practice in Canada

By Se Uk Walling, BA, RN, DPHN


### Abstract

A review in the *Medical Post* (Wysong, 1996) discussed the merit of glove and instrument changes during cancer surgery with a view to reducing the incidence of neoplastic seeding. This review stimulated the author to investigate current practices in this regard adopted by surgical staff across Canada. The author believes that a valid comparison exists between practices utilized in infection control and those which can be used to limit the problem of neoplastic seeding at the time of surgery. Results indicated a considerable interest in adopting a protocol utilizing glove and instrument changes at critical points during surgery, such as reconstruction and closure.


### Introduction

This article presents the findings of an investigation into surgical team attitudes and opinions towards certain protocols which may reduce the likelihood of neoplastic seeding during cancer surgery. Numerous authors have expressed concerns about the inadvertent spread of cancer, and especially of what has become termed "neoplastic seeding" at the time of surgery. They have suggested that specific measures, if taken intraoperatively, may reduce recurrence rates. "Neoplastic seeding," or the incidental implantation of cancer cells during surgery, defines both mechanical disruption and spread of tumor cells into normal healthy tissue.

It is well known that most tumors invade by one or more different mechanisms. These include (1) lymphatic metastasis; (2) local implantation or direct seeding (Cotran et al 1994: 250-52); (3) extension of contiguity (Thomas et al 1996); (4) putative cancer cell implantation transported on surgical knives, gloves, gowns, drapes, or during wound washing, and wound drainage or seromas (Collins 1993), and (5) haematogenous spread which relates to intraoperative tumour cell spillage into the blood stream during manipulation of a primary tumor ( Oefelein et al 1996). It has also been shown that tumor cells may have a predilection for areas of tissue injury, or "oncotaxis" (Collins 1993). Much research literature has shown that techniques and measures may be undertaken to decrease the likelihood of disseminating and implanting cancer cells in a patient's wounds during surgery.

Several authors (Basha and Penninckx 1996; Brodsky and Cohen 1991) suggested the use of intraluminal cytotoxic solutions (i.e. sodium hypochlorite, povidone - iodine 5 - 10% sol.), intraperitoneal chemotherapy and intraoperative pre-resectional bowel washout with a cytotoxic agent, to reduce the viability of exfoliated cancer cells. Adherence to what is called the "no touch isolation technique," involving avoidance of manipulation of a tumor, combined with early division of the vascular supply and, in the case of colon cancer surgery, the removal of the lymphatic drainage of the tumor-bearing segment of the colon before mobilizing and resecting the tumor segment is recommended (Basha et al 1996, Fengler 1994; Turnbull et al 1967; Wiggers et al 1988). In the latter case, adoption of a special technique of colon anastomosis is also strongly encouraged, such as employing staples or monofilament sutures, instead of using protein-based (i.e. collagen-based and multifilament sutures (Basha and Penninckx 1996; Stebbing and Mortensen 1995; Uff et al 1993).

It is also important to avoid re-use of instruments and gloves which come into direct contact with cancer cells (Clayman et al 1993; Curran et al 1996). During laparoscopic surgery for malignant conditions the excised specimen should be enclosed in a nonporous bag for removal through the abdominal wall (Nally and Preshaw 1996). Elderman et al (1996) mention that using a R.C. 400 leukocyte depletion filter reduces the risk of reintroducing tumour cells during surgery, which incorporates the intraoperative blood salvage technique. As soon as the incision is made, the edge of the wound should be protected with a plastic drape to prevent tumor cell contamination. The cut surface of the tumor must be cauterized with electrocautery and isolated from the remainder of the wound. It is important to avoid using the basin of saline in which the surgeon's gloved hands have been dipped, as it may be contaminated with cancer cells. There may also be a need for dissection of much wider margins around certain tumours (Schwartz et al 1989). During head and neck surgery, a "sticky-drape" is placed over the tracheotomy site with adhesion by Benzoin or Mastisol, which is a simple way to decrease the likelihood of implantation of cancer cells intraoperatively (Collins 1993). Hensen et al (1995) suggested, moreover, that intraoperative autotransfusion in tumor surgery should be contraindicated.

Increased awareness of operating room staff to such dangers of contamination is possibly the first step towards establishing and implementing protocols and practice capable of reducing the likelihood of neoplastic seeding. Although the outcome of the disease may be determined at the moment of diagnosis, it is anticipated that prognosis during surgery may still be optimized with adoption of the above-mentioned preventive techniques. Since it seems obvious that members of the perioperative nursing profession, in particular, have a crucial role to play in facilitating the prevention of neoplastic seeding at the time of surgery, every effort should be made to ensure that they are familiar with such methods and techniques.

### Author

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### Purpose of Study

The aims of this study were twofold: first, to stimulate interest in the subject of neoplastic seeding at the time of cancer surgery and, second, to suggest a protocol to reduce to a minimum, the possibility of neoplastic seeding in the operating room. It proposed to examine the practices of nurses and surgeons in the surgical management of cancer within the established protocol of infection control practice. An analogy may be drawn between infection control and neoplastic seeding, since neoplastic seeding is the incidental implantation during surgery of cancer cells in healthy tissue.

The author's interest was stimulated by a commentary in the *Medical Post* by Pippa Wysong (1996) which discussed a paper by A. J. Curran and his colleagues entitled "Exfoliated malignant cells in gloves and instrument washing," presented at an international conference pertaining to head and neck cancer held in Toronto in 1996 (Curran et al 1996). Curran and his research team claimed that malignant cells adhere to gloves and instruments during cancer surgery. By adopting a special washing technique, these researchers found that in 9 instances out of a total of 15 cases investigated by them, used gloves and instruments revealed malignant cells. In two additional cases malignant cells were found on gloves only. This meant that malignant cells were revealed in 11 out of 15 cases investigated, or in 71% of the total cases.

On the basis of these findings, Curran and his colleagues recommended "that all surgeons change gloves and instruments following removal of the main tumor specimen and prior to irrigation of the operating field with tumorcidal agent."(Curran et al 1996: 281).

### Methodology

In the beginning stages of the project, the investigator contacted several hospitals to gain some idea of the kind of responses her survey might elicit. Approval was gained for the study from the Medical Research Ethics Committee of the Queen Elizabeth II Health Sciences Centre in Halifax, Nova Scotia. Questions on the questionnaire sheet were numbered and coded **(See Appendix A)** to facilitate analysis. Three hundred thirty five questionnaire forms were distributed to 24 selected hospitals across Canada.

Questionnaires were returned by 89 persons. Since the exact number of recipients were unknown, it was estimated that this number constituted approximately 27% of the total number of questionnaires

originally distributed. Following tabulation of the survey results, a brief report was prepared on the findings.

## Findings and Discussion

Of the eighty nine persons who returned the questionnaires, 44 were surgeons, and 45 nurses and technicians. All respondents were presented with sixteen questions. Questions 1 to 4 inquired generally about each respondent's work setting, location and training, and questions 5 to 16 related more specifically to the aims of the study.

**Question 1:** In response to Question 1, which asked about work setting, 82% stated that they were on the staff at a metropolitan hospital, while only 8% worked at a rural or regional hospital.

**Question 2:** Question 2 asked respondents to state in which province they worked. Forty three percent of the respondents worked in the Maritime area. Details drawn from responses to this particular question are shown in the Table 1.

**Question 3:** In Question 3, 48% of the respondents reported that they operated on over 250 cancer patients per year.

**Question 4:** 87% of the respondents replied that they worked at a teaching hospital.

**Question 5:** The most common form of cancer treatment reported by respondents is colon cancer. Complete findings are presented in Figure 1.

**Question 6:** The number of respondents representing each of the eight different professional categories is presented in Figure 2.

**Question 7:** Sixty nine out of the 89 respondents were female.

**Question 8:** Over 60% of respondents reported that they have been practising in the operating room for more than 15 years. Forty three per cent of respondents with experience of over 15 years indicated they were in favor of using more than one set of instruments in reconstruction and closure.

**Question 9:** Seventy eight respondents were trained in the teaching hospital environment, and 7 respondents were trained at a cancer centre and teaching hospital. Others were trained at regional or general hospitals, or at a RNA college and research facility.

**Question 10:** Fifty five out of 89 respondents (62%) reported that it was worthwhile to use more than one set of sterile surgical instruments during a cancer operation. These stated that a second set of instruments should be used for reconstruction or anastomosis, or wound closure, or before a skin graft. Twenty five out of the 44 surgeons (55.6%), and 9 out of the 45 nurses (20%) who responded were not in favour of using more than one set of instruments during cancer surgery. Reasons given by these respondents varied, as may be seen by the following comments extracted from the questionnaire sheet:

- "It depends on whether isolation of instruments used on the tumor occurs with spillage etc."
- "No evidence to suggest benefit."
- "Cost implication" [should be examined].
- "Changing instruments will not prevent tumour shedding."
- "Never a part of training."
- In case of nurses, there is a need to... "depend on the practice and technique of the surgeon."
- "Viability of cancer cells extraordinarily minimal."
- "Insufficient knowledge to make an informed decision."

**Question 11:** Approximately 57% of respondents reported that they did not change gloves after the removal of a cancerous tumor during cancer surgery. However, 42.7% changed gloves after removal of a lesion prior to reconstruction or wound closure, before skin graft, before anastomosis or if the tumor cell spilled during cancer surgery.

**Question 12:** More than 49% of respondents reported that they change gloves and instruments following section, intersection, violation of a tumor, or during or after the procedure of frozen section. The reasons given for not changing gloves and instruments for the procedure of frozen section already have been mentioned in Question 10.

**Question 13:** Only 3.4% of respondents reported to have used intraoperative luminal instillation cytotoxic agent at their hospital.

**Question 14:** More than 90% of respondents reported that they have never used intraperitoneal chemotherapy at their hospital.



# Appendix A - **Questionnaire**

### General information:

**1. Description of workplace**
001. metropolitan hospital
002. rural hospital
003. other
**2. Location of workplace**
004. the Maritimes
005. Ontario
006. Québec
007. Manitoba
008. Saskatchewan
009. Alberta
010. British Columbia
011. Newfoundland/Labrador
012. Yukon Territory
**3. How many patients with cancer do you operate on per year?**
013. 00 - 50
014 51-100
015. 101-150
016. 151-200
017. 201-250
018. 251-300
019. over 300
**4. Is your institution a teaching hospital?**
020. yes
021. no
**5. The most common form of cancer treated at your institution is**
022. lung
023. breast
024. colon
025. larynx
026. other

### Respondent profile:

**6. Are you -**
047. an operating room nurse?
048. a general surgeon?
049. a cancer specialist?
050. other ? If other, please specify
*a. If you answered no to question 6 please explain why.*
b. If *you answered yes to question 6. please explain why.*
***7. Are You -***
051. ☐ male?
052. ☐ female?
**8. How long have you been practising in your field?**
053 under 5 years
054 5 to 10 years
055 10 to 15 years
056 15 to 20 years
057 over 20 years
**9. Where did you do your training?**
058 teaching hospital
059 cancer treatment centre
060 other

### Questions Relating Specifically to Operational Procedures:

**10. Based on your training and experience, do you think it worthwhile to use more than one set of sterile surgical instruments during a cancer operation?** (e.g. one set for the removal of the tumor, and another for closure and/or reconstruction work.
027 ☐ no 028 ☐ yes

**11. Would you routinely change gloves during an operation on a cancerous tumor?**
029. ☐ yes 030. ☐ no

**a.** If *you answered **no** to question 11, please proceed to 11b.*
*If you answered **yes**. at what point, or points, in the operation would you change gloves?*
***b.** If you answered **no** to question 11, please give your reasons.*
**12. Would you change gloves and instruments during the procedure of frozen section with regard to cancer surgery?**
031. ☐ no
032. ☐ yes. State at what point.
033. ☐ perhaps, but it would depend upon
**13. How often have you used intraoperative luminal instillation cytotoxic agent in your present institution with regard to cancer surgery?**
034. never
035. occasionally
036. frequently
037. always
**14. How often have you used intraperitoneal chemotherapy in your present institution with regard to cancer surgery?**
038. never
039. occasionally
040. frequently
041. always
**15. Have you ever used any of the following agents or procedures at any other institution?**
042. yes, intraoperative luminal instillation cytotoxic agent
043. yes, intraperitoneal chemo therapy
044. (yes, have used both
045. (no, have used neither
046. (no, have used neither. but instead used the following agent:
**16. What specific procedures do you think must definitely be taught in nursing and medical schools in order to ensure a future high quality of perioperative nursing practice during cancer surgery?**

*Thank you for your participation.*

**Table 1** Number of Questionnaires and Survey Responses. Numbers and Percentages of Nurses and Surgeons who Responded to the Survey, by Province (questionnaire item codes 004 - 012)

| Canada | Sample | Nurses | | Surgeons | |
|---|---|---|---|---|---|
| **Provinces** | **#Distributed** | **#Responses** | **%of Sample** | **#Responses** | **%of Sample** |
| Maritimes | 116 | 20 | 17.2 | 30 | 25.9 |
| Quebec | 93 | 3 | 3.2 | 4 | 4.3 |
| Ontario | 22 | 2 | 9.1 | 2 | 9.1 |
| Manitoba | 17 | 3 | 17.6 | 1 | 5.9 |
| Saskatchewan | 9 | 5 | 55.6 | 2 | 22.0 |
| Alberta | 21.0 | 1 | 4.8 | 1 | 4.8 |
| B.C. | 25.0 | 6 | 24.0 | 2 | 8.0 |
| Newfoundland | 32.0 | 5 | 15.6 | 2 | 6.3 |
| Yukon | 0.0 | 0 | 0.0 | 0.0 | 0.0 |

**Question 15:** Seven per cent of respondents reported that they have used intraoperative luminal instillation of cytotoxic agent and 5.6% of respondents have used intraperitoneal chemotherapy. Two point three per cent of respondents have used both, but at a hospital other than the one at which they currently work.

**Question 16:** With regard to question 16, the majority of respondents recommended education at the nursing and medical school level in order to ensure a future of high quality of perioperative care during cancer surgery. In their own words they stated:

- [There should be stress on] "importance of using isolation techniques for contaminated surgical instruments, gloves, etc."
- "Immaculate sterile techniques" [should be employed].
- "No touch technique" [should be employed].
- "Good aseptic techniques" [should be practised].
- [What is needed is a] "Research based practice of isolating instruments and changing gloves."
- "Cross contamination" [should be investigated].
- "ORNAC could develop some standards for this area."
- [There should be a focus] "on operating room details."
- [Schools should focus on] "the concept of microtumor, and how biopsy and surgical intervention should be accomplished."
- [There is a need for] "gentle handling of tumor."
- [Are the suggested practices] "evidence-based?
- Have studies shown [that] this evidence based data [will show] difference[s] in outcome and [warrant additional] financial expenditures?"
- "Principles of surgical oncology and biology of various types of tumors" [should be stressed in medical and nursing schools].
- "Evidence-based medicine should be the standard against which perioperative practice is judged".
- "Minimal handling of equipment, drapes and instruments is important, as is minimal handling of tissue".

## A Commentary on What Reviewers have Perceived as Possible Sources of Bias

At the recent World Conference of Operating Room Nurses, held in Toronto, September, 1997, nurses from many countries expressed considerable interest in these research findings. This was most encouraging. Some reviewers, however, noted two areas which to them appeared to be possible sources of bias. The first of these concerned the overabundance of successfully completed questionnaires from the Maritime Provinces (56% of the returned questionnaires). To this, the author replies that while the preponderance of responses from the Maritime undoubtedly did sway the overall results of the study in favour of attitudes held in the eastern region, the expense of repeatedly mailing out packets of questionnaires precluded the strenuous elicitation of responses from geographic regions where responses were far less readily forthcoming, even though ample questionnaire sheets were originally sent. The need to keep mailing costs within budget was important since to date, the author's work has been entirely self-funded.

The second perceived source of bias concerned the results which showed a far larger proportion of nurses than surgeons (80% of nurse respondents as contrasted with 44% of surgeons) felt that standards should be implemented and upheld. Certain reviewers felt this fact should be addressed further in the study since the attitudes of the two subgroups differed in such a statistically significant way. To this the author replies that her main initial goal was to survey the entire operating room staff, not independent subgroups. The breakdown into significant subgroups arose from the findings, and should be viewed as heuristic. Especially valued is one reviewer's comment that, despite this problem, the study "does focus important attention to the dilemmas faced by OR personnel in optimal handling of equipment in a tumor resection." The author looks forward to pursuing the subject in greater depth and hopes that other researchers will follow her lead, especially with relation to the two important subgroups, and the implications which may arise from related research findings.

## Summary and Conclusions

This study elicited 89 respondents' opinion of their practices and techniques of cancer surgery. Respondents reported (62%) in favour of using more than one set of sterile instruments, and 49% stated that they avoided reusing gloves and instruments during the procedure of frozen section to reduce the likelihood of neoplastic seeding. Neoplastic seeding is not always avoidable, but it is heartening to find that over half the respondents considered the measures, suggested by numerous research articles, as well as the techniques many themselves used, effective enough to prohibit them from reusing instruments and gloves during cancer surgery. When we consider the effort taken to avoid bacterial infection at the time of sur-

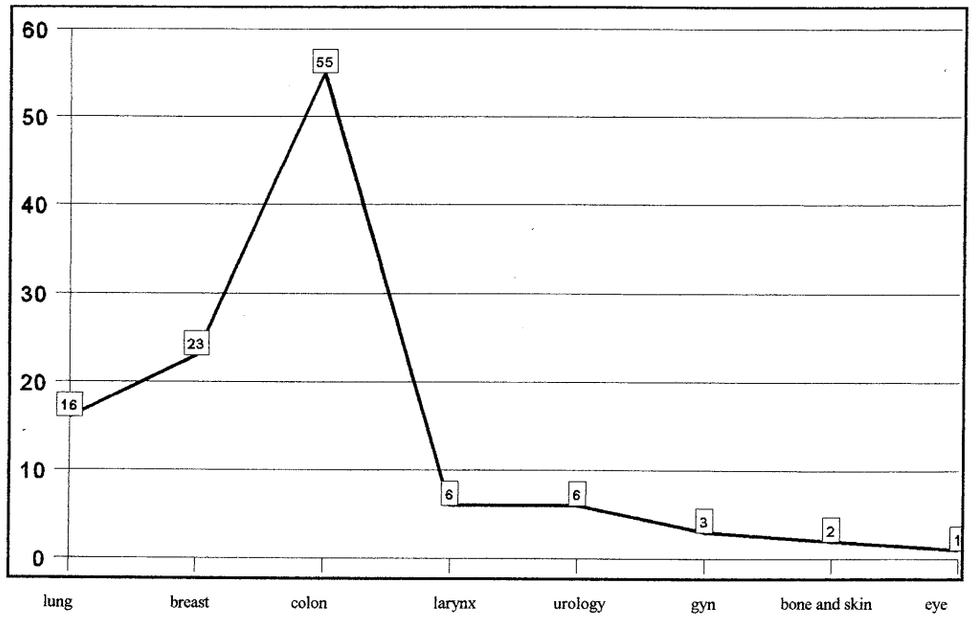


***Figure 1.*** *(Questionnaire code items 022 to 026).*

**Number of respondents**

| | |
|---|---|
| 2 | under 5 years experience |
| 8 | 5-10 years experience |
| 25 | 10-15 yrs experience |
| 26 | 15-20 yrs experience |
| 28 | over 20 yrs experience |

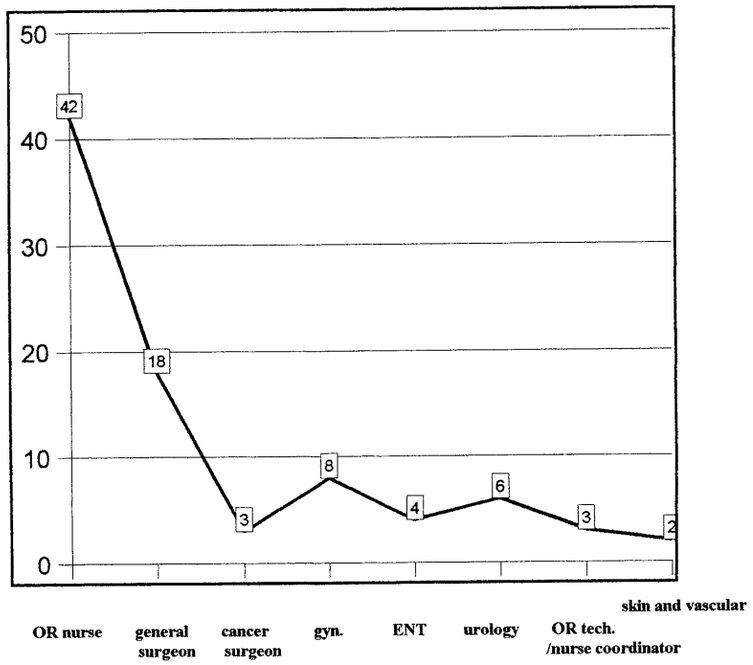


***Figure 2.*** *(Questionnaire code items 047 to 050).*

gery, the inevitable conclusion would seem to be that a comparable parallel effort should be made to reduce to a minimum the chance of neoplastic contamination.

The author wishes to express her appreciation of all participants in this study, especially those who took the time to fill out and return questionnaires. (It might be added that 28% of those who returned questionnaires requested to receive findings deriving from this research survey.)

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