BC Cancer Clinical Pharmacy Guide

# Case Study Examples

## Contents:



The following case studies demonstrate a systematic approach to the clinical review and assessment of cancer drug orders using Module 2: Cancer Drug Order and Assessment.

Checklists of this procedure are found in Appendix A: Clinical Cancer Drug Order Review Checklist - Parenteral and Clinical Cancer Drug Order Review Checklist - Take home.

Summaries of all BC Cancer treatment protocols and preprinted orders can be found on the BC Cancer website (www.bccancer.bc.ca) under ***Chemotherapy Protocols***.

# Example Case Study 1a: BRAJFEC

Patient D.N. (BC Cancer ID #XX-45678, MRN 0123456XX) is a 48-year-old female in good health, recently diagnosed with breast cancer. The pathology report indicates: invasive lobular carcinoma, high risk, Grade 3, tumor size 2.5 cm, no lymphovascular invasion (0/11 lymph nodes involved), estrogen and progesterone receptor positive (3+/3+), HER2 negative. D.N. has had a mastectomy and is scheduled for cancer treatment.

She arrives in preparation for treatment to start on May 27. She had baseline blood tests performed at an outside lab 2 weeks ago, as follows:

Lab results - May 12

| | | | | | |
|---|---|---|---|---|---|
| WBC | 5.3 | Bilirubin | 12 | LDH | 409 |
| ANC | 4 | Creatinine | 55 | GGT | 29 |
| Hgb | 120 | Alk Phos | 93 | | |
| Platelets | 320 | AST | 35 | | |

The Cancer Genetics and Genomics Laboratory has reported that her *DPYD* Predicted Activity Score is 2.0 and her Genotype is variant negative.

Pharmacy received a **written** order on a BRAJFEC preprinted order sheet:

| | |
|---|---|
| Epirubicin | 160 mg IV push |
| Fluorouracil | 800 mg IV push |
| Cyclophosphamide | 800 mg IV in 100 to 250mL NS over 20 to 60 minutes |

BSA calculated by the ordering physician is 1.65 $m^2$ (see height and weight in Step 1).

## Step 1: Verify Patient Identity

Two identifiers were used to confirm that the order was written for the correct patient: name (D.N.) and BC Cancer ID number (XX-45678). The BC Cancer ID number verifies that D.N. is registered with BC Cancer. If a BC Cancer ID number is not available, the

pharmacist should check with the ordering prescriber or the BC Cancer Registry (1-800-663-3333 x 674610) to determine if the patient is registered with BC Cancer and BC Cancer benefit drugs can be dispensed.

A double signed current patient height and weight are also necessary for Cycle 1 calculation of BSA and cancer treatment dose (see Height and Weight Measurement and Documentation Procedure). The following height and weight were documented in the patient chart on May 26 which were signed by two staff:

Height: 5'5" (165.1 cm)

Weight: 130 lb (59.1 kg)

## Step 2: Confirm Protocol Matches Clinical Indication and Eligibility for Treatment

BRAJFEC is a BC Cancer protocol currently in use as adjuvant therapy for breast cancer patients. A current version of this protocol can be found on the BC Cancer website. Before proceeding, always check that the version you are using is the most current. The revision dates are found in the footer, and on the last page of the protocol. It is possible that the protocols themselves may be changed during the course of a patient's treatment. Changes to protocols are announced monthly in the Systemic Therapy Update newsletter.

The "AJ" in the protocol name indicates that this is an adjuvant treatment, used in combination with surgery or radiation. This protocol has a curative intent.

### Determine diagnosis

This information should be available in the physical or electronic chart. If a chart is not available, you may wish to contact the ordering prescriber to confirm that the protocol chosen is consistent with the diagnosis.

In this example, D.N. is diagnosed with breast cancer, with no axillary lymph node involvement.

### Does the diagnosis match the eligibility requirements for the protocol?

To be eligible for this treatment, patients must be less than or equal to 60 years of age or a fit patient greater than 60 years of age, with one or more axillary lymph node metastasis(es). Patients may also have high risk, node negative disease to qualify for this protocol.

D.N. is less than 60 years old (48) with high risk disease, and no lymph node involvement. She is in good health and does not have any significant heart disease (an exclusion factor for this protocol). Therefore, the treatment protocol is appropriate for the diagnosis.

The title of the protocol and the "BR" at the beginning of the protocol code indicate that this treatment is for breast cancer so you can proceed with checking the rest of the order. If a lung protocol had been ordered, further investigation would be required (i.e., the prescriber would have to be contacted because the wrong protocol had been ordered, or perhaps the order had been written for the wrong patient).

### Benefit status requirements

Is the protocol ordered Class I or Restricted Funding (R)? Protocols with a restricted funding designation require CAP approval through the BC Cancer Compassionate Access Program **prior** to initiation of therapy. Protocols and preprinted orders indicate when CAP approval is required. The BC Cancer Benefit Drug List [Systemic Therapy - Reimbursement & Forms] also indicates the designation for each drug and protocol. Protocol codes are required at the time of drug order entry.

Because D.N. is a resident of British Columbia enrolled in the Medical Services Plan of BC and has been registered with BC Cancer, medications for treatment of her cancer are benefits of the BC Cancer Systemic Therapy Program. The cancer drugs to be administered in this protocol (epirubicin, fluorouracil and cyclophosphamide) are all Class I drugs and the cancer drug protocol does not require any extra documentation regarding benefit status.

## Step 3: Review Medical History

Medications, medical history, allergy status and pregnancy status should be confirmed.

D.N. is not currently taking any medications or complementary/alternative medicines. Her past medical history is unremarkable and no external surgeries or treatments that

may conflict are scheduled. She does not have any known allergies. The patient will need to have a negative pregnancy test confirmed or be assessed as not being of "child bearing potential" prior to start of her cancer drug treatment (see Pregnancy Assessment and Education for Systemic Therapy Patients Procedure: V220).

## Step 4: Check Timing of Treatment

D.N. has had no previous treatment for breast cancer. Her first treatment date will be May 27, which will be Day 1 of Cycle 1.

No new concerns that may require the patient to be reassessed occurred since the orders were written.

## Step 5: Determine Patient's Body Surface Area

Calculate the patient's body surface area, using the Mosteller formula:

$$\text{BSA } (m^2) = \sqrt{\frac{height(cm) \times weight(kg)}{3600}}$$

$$= \sqrt{\frac{165.1cm \times 59.1kg}{3600}}$$

$$= 1.65\ m^2$$

Ensure that the body weight and height are the most recent results.

## Step 6: Check Appropriateness of Cancer Drug Dose(s)

Calculation of doses for Cycle 1:

| | |
|---|---|
| Epirubicin: | 100 mg/m$^2$ × 1.65 m$^2$ = 165 mg IV |
| Fluorouracil: | 500 mg/m$^2$ × 1.65 m$^2$ = 825 mg IV |
| Cyclophosphamide: | 500 mg/m$^2$ × 1.65 m$^2$ = 825 mg IV |

These calculated doses are within 5% of the doses ordered by the prescriber so the prescriber's orders are acceptable and can be processed as written. If there was a variance of greater than 5%, the prescriber must be contacted and the discrepancy resolved, as per Systemic Therapy Treatment Delivery Process Policy: III-10 [SHOP].

Medications and doses to be administered, must be documented on the patient chart as well as on the pharmacy record.

The maximum cumulative dose for epirubicin is 720 – 1000 mg/$m^2$ according to the BC Cancer epirubicin monograph. The BRAJFEC protocol, however, specifies a maximum of 720 mg/$m^2$, so this value will be used. For D.N., this would be 720 mg/$m^2$x 1.65 $m^2$ = 1188 mg. If the patient received the full six cycles of treatment at full dose, the total epirubicin administered would be 990 mg, which is within the maximum cumulative dose guideline. She has not received any prior cancer drug treatment.

## Step 7: Review Laboratory Values

Lab tests are performed routinely throughout treatment, depending on the protocol. In this example, there are baseline tests (i.e., prior to the initiation of treatment), tests before each treatment and tests done if clinically indicated.

D.N. has lab results dated May 12. These baseline tests have been ordered, as outlined in the protocol. The lab work is acceptable because it was drawn within 4 weeks (28 days) of starting treatment.

### Comparison of lab tests to protocol

D.N.'s lab results are within normal limits so treatment can proceed as ordered.

As D.N.'s *DPYD* Predicted Activity Score is 2.0 and one of the variants of concern have not been detected, she is likely a normal metabolizer and no dose reduction of fluorouracil is required.

## Step 8: Verify Appropriate Method of Drug Delivery

Prepare and administer as per protocol, following sterile technique and safe handling procedures for hazardous drugs. As indicated in the BRAJFEC protocol, epirubicin and fluorouracil are dispensed in a syringe and given as IV push. Cyclophosphamide for IV

infusion is dispensed in a 100 mL Normal Saline minibag for doses less than or equal to 1000 mg.

## Step 9: Monitor for Potential Cancer Drug Toxicity

Epirubicin is a vesicant, so the pharmacy and nursing staff should review Prevention and Management of Extravasation of Chemotherapy Policy: III-20 [SHOP] prior to administration.

## Step 10: Verify Protocol-Related Supportive Care Provided

### Antiemetics

The protocol specifies an antiemetic regimen for highly emetogenic chemotherapy (SCNAUSEA). The patient should have been given prescriptions for $NK_1$ and 5-$HT_3$ antagonists (either Akynzeo® or aprepitant plus ondansetron), dexamethasone, and either olanzapine, prochlorperazine or metoclopramide. These are not supplied or reimbursed by BC Cancer and should be filled at a community retail pharmacy.

### Filgrastim (G-CSF)

If the patient develops febrile neutropenia while on this protocol, there is an option for the patient to start filgrastim (G-CSF). If the prescriber chooses that option, a completed Filgrastim Special Authority Request Form [Systemic Therapy - Reimbursement & Forms] must be submitted to Pharmacare for outpatients. Please note that for outpatient use, the cost of filgrastim is not reimbursed by BC Cancer. For eligible inpatients, the indication for filgrastim is filled in at the time of OSCAR billing by CON hospitals. Filgrastim (G-CSF) Special Authority forms are not required for inpatient treatment but may still be completed so that patients will receive Pharmacare coverage for any future filgrastim filled in community for subsequent cycles.

## Step 11: Counsel Patient

Patients starting a new protocol require counselling to understand their new cancer medications. For oral medications, pharmacists are required to counsel at the time of dispensing. This patient is starting parenteral medications only. Depending on the cancer centre or CON site, usually a nurse will counsel patients about their parenteral

medications. The supportive medications and handouts will be provided by the community pharmacy at the time of dispensing (e.g., Akynzeo®, aprepitant, ondansetron, dexamethasone, etc.).

## Resources

**Drug Information for Patients**

Patient information for specific cancer medications or protocols can be found on the BC Cancer website under:

- BRAJFEC Patient Handout
- Cancer Drug Manual Individual Drug Patient Handouts [Drug Index]
    - Cyclophosphamide
    - Epirubicin
    - Fluorouracil

**Drug Information for Health Professionals**

Information for health professionals on the above medications can also be found on the BC Cancer website:

- BRAJFEC Protocol
- Cancer Drug Manual [Drug Index]
- ***Chemotherapy Preparation and Stability Chart – Drugs A to K*** [Cancer Drug Manual]
- SCNAUSEA

**Other Resources**

The Protocol and Individual Drug Patient Handouts often refer to additional symptom and side effect information found elsewhere on the BC Cancer website. Additional information and other handouts can be located by referencing the Pharmacy Symptom and Side Effect Management Resource Guide. Other patient specific handouts that may be useful for this patient could include:

- Cancer Drug Manual Appendix [Information for Patients]
    - Natural Health Products and Breast Cancer
    - Sun Sensitivity and Sunscreens

- Coping with Cancer: Nutrition Information
    - Practical Tips to Help Manage Nausea
    - Food Ideas to Help with Taste and Smell Changes
- Coping with Cancer: Managing Symptoms & Side Effects
    - Nausea and Vomiting
    - Managing Fatigue (Tiredness)
- Safe Handling handouts are available and should be provided to this patient as they are receiving a Group 1 Hazardous Drug:
    - Cancer Drug Manual [Safe Handling]
        - Guidelines for Handling Cancer Drugs and Body Fluids in the Home
- As this patient is of childbearing potential, the following handout may be useful:
    - Preventing Pregnancy during Cancer Treatment

# Subsequent Doses

## Cycle 2: First occurrence of low counts, no febrile neutropenia

D.N. returns on June 17 for her second cycle of BRAJFEC. She complains of some mild fatigue but no episodes of fever. Her weight remains at 59 kg. Subsequent BSA recalculations will be done only if, in the prescriber's opinion, it is warranted by a change in the clinical status of the patient, or if there was a weight change significant enough that it results in a dose variance of greater than 5%, or if there has been a weight change of greater than 10% from cycle 1 of this regimen.

BRAJFEC orders written on June 14 (during the oncologist appointment) for administration on June 17:

| | |
|---|---|
| Epirubicin | 160 mg IV push |
| Fluorouracil | 800 mg IV push |
| Cyclophosphamide | 800 mg IV in 100 to 250 mL NS over 20 to 60 minutes |

Due to scheduling, patients may be seen several days prior to their cancer drug administration date, with blood work ordered either prior to or on the day of treatment.

In this case, the prescriber ordered bloodwork for the day of treatment. Generally, the patients are asked to go to the laboratory at least one to two hours prior to their treatment time to allow time for the lab to process and report the results.

| Lab results – June 17 | | | |
|---|---|---|---|
| WBC | 2 | Bilirubin | 12 |
| ANC | 1.3 | Creatinine | 55 |
| Hgb | 115 | | |
| Platelets | 80 | | |

This is Cycle 2 of the same protocol that the patient had last time, so begin the clinical check by considering the timing of the treatment (time interval between cycle 1 and cycle 2).

BRAJFEC protocol indicates that this treatment is to be given every 21 days. June 17 is 3 weeks (21 days) from Day 1 of Cycle 1, so the timing of the appointment is appropriate.

Lab work was drawn that morning so timing of lab results is acceptable. However, D.N.'s ANC is low (less than 1.5) and her platelets are low (less than 100). A review of the protocol indicates that the treatment should be delayed by one week. This necessitates a call to the ordering prescriber for further discussion.

## Results

The prescriber writes orders to delay treatment for one week and D.N. is rescheduled to begin Cycle 2 on June 24. Orders for lab work and future appointments are adjusted accordingly. Documentation of this change is recorded on the physical patient chart or Cerner Pharmacy Clinical Check Powerform and the pharmacy treatment record (if applicable). Include a reason for the change in the documentation, as this may influence future treatment decisions.

BRAJFEC orders for administration June 24:

| | |
|---|---|
| Epirubicin | 160 mg IV push |
| Fluorouracil | 800 mg IV push |
| Cyclophosphamide | 800 mg IV in 100 to 250 mL NS over 20 to 60 minutes |

Timing of appointment is appropriate (delay of one week from previously scheduled date).

- Lab work is within acceptable parameters, i.e., ANC has recovered to greater than or equal to 1.5 and platelets to greater than or equal to 100.

- Doses are within 5% of calculated doses for this protocol.
- According to the *Dose Modifications* Section of the protocol, D.N. can receive 100% of the previous cycle's dose.

Doses can be prepared and administered to patient as ordered; treatment documented in physical or electronic patient chart and pharmacy preparation record.

## Cycle 3: Second occurrence of low counts, no febrile neutropenia

D.N. returns on July 15 for Cycle 3 and again, her counts are low. A new order is written to delay her treatment by one week.

| Lab results – July 15 | | | |
|---|---|---|---|
| WBC | 2.1 | Bilirubin | 12 |
| ANC | 0.95 | Creatinine | 55 |
| Hgb | 115 | | |
| Platelets | 83 | | |

D.N. returns on July 22. No episodes of fever; reports moderate fatigue. Timing of appointment is appropriate as ordered. No new labs have been done since July 15. The prescriber is contacted to order bloodwork for July 22.

Lab results and BRAJFEC protocol orders for July 22 are:

| Lab results – July 22 | | | |
|---|---|---|---|
| WBC | 3.9 | Bilirubin | 12 |
| ANC | 1.6 | Creatinine | 55 |
| Hgb | 115 | | |
| Platelets | 103 | | |

Since this delay was after the second occurrence of low counts, the prescriber has ordered 75% of the previous cycle dose per the protocol's *Dose Modification* section:

| | |
|---|---|
| Epirubicin | 120 mg IV push |
| Fluorouracil | 600 mg IV push |
| Cyclophosphamide | 600 mg IV in 100 to 250 mL NS over 20 to 60 minutes |

All written doses are acceptable, so medication may be prepared and administered as ordered and documentation completed as in previous cycles.

## Cycle 4

D.N. returns for Cycle 4 on August 12 and lab tests are ordered that morning.

BRAJFEC protocol orders for August 12 are:

| | |
|---|---|
| Epirubicin | 120 mg IV push |
| Fluorouracil | 600 mg IV push |
| Cyclophosphamide | 600 mg IV in 100 to 250 mL NS over 20 to 60 minutes |

The treatment interval and lab results are appropriate and bloodwork is within acceptable limits. The patient had a 75% dose reduction in the previous cycle and will continue further cycles at this dose.

Doses are prepared and administered as ordered. Documentation is completed.

## Cycles 5 and 6

D.N. does not experience any other treatment delays for the remaining two cycles of this protocol and her chemotherapy treatment is completed.

Note: if the prescriber were to order a 7$^{th}$ cycle, prior approval from the **Compassionate Access Program** [Systemic Therapy] would be required as the protocol indicates a total of 6 cycles only under the *Treatment* section. Approval must be granted before the patient is eligible to receive further treatment.

# Example Case Study 1b: BRAVDOC

Four years later, D.N., now 52 years old, returns complaining of bone pain and shortness of breath. A diagnosis of metastatic disease with pulmonary and osseous involvement is confirmed by CT and bone scan. She is scheduled to receive cancer drug treatment with the BRAVDOC protocol on May 22.

Lab work – May 8 (2 weeks prior to first cycle of treatment)

| | | | |
|---|---|---|---|
| WBC | 7 | Bilirubin | 10 |
| ANC | 3.9 | Alk Phos | 69 |
| Hgb | 128 | ALT | 24 |
| Platelets | 216 | AST | 30 |

Written orders received on a BC Cancer preprinted order.

Treatment plan: Docetaxel 155 mg IV every 21 days, as indicated in the BRAVDOC protocol.

## Step 1: Verify Patient Identity

D.N. is still a B.C. resident and retains her previously assigned BC Cancer ID number (XX-45678). Patient-specific information: height 165 cm, weight 115 lbs (52.3 kg), as of May 8. The height and weight were confirmed to be current and double-signed since her last double-signed recorded measurements were done four years ago (see Height and Weight Measurement and Documentation Procedure.) Her ECOG performance status is 1.

## Step 2: Confirm Protocol Matches Clinical Indication and Eligibility for Treatment

BRAVDOC is a BC Cancer protocol used for treatment of advanced breast cancer. The current version of this protocol can be found on the BC Cancer website. Once again, ensure that you are using the most current version.

The “AV” in the protocol name indicates that this is treatment for advanced, metastatic cancer.

### Determine diagnosis

D.N. was treated with 6 cycles of BRAJFEC four years ago, for primary treatment of breast cancer. Diagnosis for metastatic disease has been confirmed by a bone scan (osseous involvement) and CT scan (pulmonary involvement).

### Does the diagnosis match the eligibility requirements for the protocol?

In the eligibility section of the BRAVDOC protocol, there is a list of approved indications for the use of this protocol. D.N. is eligible for this treatment based on a diagnosis of metastatic breast cancer, ECOG status of 1, and a life expectancy greater than 3 months.

### Benefit status requirements

The first 8 cycles of the BRAVDOC protocol has a Class I indication; however further cycles would require approval from the **Compassionate Access Program** [Systemic Therapy] prior to the patient receiving cycle 9.

## Step 3: Review Medical History

Medications, medical history, allergy status and pregnancy status should be reviewed again.

D.N. does not take other medications or complementary/alternative medicines. Her past medical history is otherwise unremarkable with no non-oncology conditions (such as active infection) and external surgeries or treatments that may conflict. She confirms she still does not have any known allergies. She will need to have a negative pregnancy test confirmed or be assessed as not being of “child bearing potential” prior to the start of her cancer drug treatment (see Pregnancy Assessment and Education for Systemic Therapy Patients Procedure: V220).

## Step 4: Check Timing of Treatment

Previous treatment was four years ago. This is her first cycle of treatment for relapse. Her first treatment date will be May 22.

No new concerns that may require the patient to be reassessed occurred since the orders were written.

## Step 5: Determine Patient's Body Surface Area

Calculate body surface area using the Mosteller formula:

$$\text{BSA } (m^2) = \sqrt{\frac{height(cm) \times weight(kg)}{3600}}$$

$$= \sqrt{\frac{165cm \times 52.3kg}{3600}}$$

$$= 1.55\ m^2$$

## Step 6: Check Appropriateness of Cancer Drug Dose(s)

Dose calculation for Cycle 1:

Using 100 mg/$m^2$, as indicated in the BRAVDOC protocol, the docetaxel dose is calculated to be 155 mg, as prescribed. There is no variance in the dose, therefore proceed with checking the lab work, as per Systemic Therapy Treatment Delivery Process Policy: III-10 [SHOP].

Medication and dose to be administered must be documented on the patient chart as well as on the pharmacy treatment record.

Docetaxel does not require monitoring for cumulative dosing.

## Step 7: Review Laboratory Values

Lab work for current treatment is from 2 weeks ago. The lab work is acceptable because it was drawn within the required 4 weeks (28 days) of starting Cycle 1 of treatment. All baseline tests have been ordered.

### Comparison of lab tests to protocol

All lab values fall within normal range so treatment can proceed as ordered.

## Step 8: Verify Appropriate Method of Drug Delivery

The protocol indicates docetaxel 100 mg/$m^2$ should be administered IV in 250-500 mL NS or D5W over 1 hour using non-DEHP equipment. In accordance with the Cancer Drug Manual's Chemotherapy Preparation and Stability Chart (diluent) and IV Bag Size Selection Table (bag size), docetaxel 155 mg would be prepared in a 250 mL non-DEHP NS bag.

## Step 9: Monitor for Potential Cancer Drug Toxicity

The duration of infusion for docetaxel is designated as 1 hour; however, there are precautions, due to infusion-related reactions. For docetaxel, a prescriber must remain on site for 30 minutes following the start of the infusion for every treatment. Refer to Infusion Related Drug Reaction Management – Physician or Nurse Practitioner Coverage During Delivery of Selected Systemic Therapy Drugs Policy: III-60 and associated Appendices [SHOP] for more information. Although this is not directly a pharmacy consideration, pharmacists should be aware of these precautions. Treatment appointments must be scheduled during a time when a prescriber is present in the facility.

Docetaxel is an irritant and can cause pain and local tissue necrosis if extravasated, as indicated under *Precautions* section in the protocol and Prevention and Management of Extravasation of Chemotherapy Policy: III-20 [SHOP].

Docetaxel-induced onycholysis (nail changes) and cutaneous toxicity of the hands may be prevented by wearing frozen gloves starting 15 minutes before docetaxel infusion and continuing for 15 minutes following the docetaxel infusion. Frozen gloves should be replaced after 45 minutes of wearing to ensure that the hands remain cold during the entire docetaxel infusion.

## Step 10: Verify Protocol-Related Supportive Care Provided

Dexamethasone is given to reduce fluid retention and to reduce the severity of the infusion-related reactions as well as cutaneous toxicity associated with docetaxel administration.

As specified in the protocol, the dexamethasone dose is 8 mg PO BID for 3 days, starting one day prior to each docetaxel administration. Patient must receive a

minimum of 3 doses of dexamethasone prior to docetaxel administration. Pharmacy staff may wish to have confirmation that the patient has taken their premedications appropriately, prior to preparing the cancer drug treatment.

Supportive care medications are not reimbursed by BC Cancer, and should be obtained from a community retail pharmacy. Additional antiemetics are not usually required with this protocol.

## Step 11: Counsel Patient

Patients starting a new protocol require counselling to understand their new cancer medications. For oral medications, pharmacists are required to counsel at the time of dispensing. This patient is starting parenteral medications only. Depending on the cancer centre or CON site, usually a nurse will counsel patients about their parenteral medications.

### Resources

**Drug Information**

Information for the BRAVDOC protocol and docetaxel can be found for patients and health professionals on the BC Cancer website under:

- BRAVDOC Patient Handout and Chemotherapy Protocol
- Cancer Drug Manual Individual Drug Monographs and Patient Handouts [Drug Index]
    - Docetaxel

**Other Resources**

The Protocol and Individual Drug Patient Handouts often refer to additional symptom and side effect information found elsewhere on the BC Cancer website. Additional information and other handouts can be located by referencing the Pharmacy Symptom and Side Effect Management Resource Guide.

# Subsequent Doses

D.N. continues treatment and is now at her third cycle. She presents 21 days following her 2nd cycle, on July 3, with lab work taken the same day.

| Lab results – July 3 | | | |
|---|---|---|---|
| WBC | 2.5 | Hgb | 116 |
| ANC | 0.93 | Platelets | 103 |

Treatment is delayed for 1 week due to low ANC, with lab work reordered, including liver enzymes.

D.N. returns 1 week later, July 10, with the following lab work:

| Lab results – July 10 | | | |
|---|---|---|---|
| WBC | 3.3 | Alk Phos | 257 |
| ANC | 1.4 | ALT | 123 |
| Hgb | 118 | AST | 88 |
| Platelets | 140 | Bilirubin | 20 |

Her weight has decreased to 50 kg; however, the prescriber decided that a recalculation of BSA was not required, and the BSA remained (1.55 $m^2$) the same as previously calculated.

Due to continued low ANC, and an elevation of hepatic enzymes, a dose reduction of 75% is ordered. The new dose is calculated to be 116 mg. As the weight change is less than 10%, and a recalculated dose (using the new lower weight and BSA) would still fall within 5% of the ordered dose of 116 mg, pharmacy proceeds with the dose as ordered.

D.N. continues treatment without delay or any further dose reductions. She receives a total of 8 cycles, as indicated in the treatment protocol.

Note: if the prescriber were to order a 9th cycle, this would require approval from the **Compassionate Access Program** [Systemic Therapy]. Approval must be granted *prior* to the patient receiving cycle 9.

# Example Case Study 2: Oral Cancer Drug Treatment with LUAVERL

Patient B.B. (BC Cancer ID #XX-12345) is a 69-year-old female non-smoker, who has recently been diagnosed with metastatic lung adenocarcinoma. She arrives on June 21 in pharmacy with a prescription for erlotinib.

She had baseline blood tests performed at an outside lab 2 weeks ago, as follows:

Lab results - June 7

| | | | | | |
|---|---|---|---|---|---|
| WBC | 4.4 | Bilirubin | 4 | GGT | 16 |
| ANC | 2.8 | Creatinine | 63 | LDH | 231 |
| Hgb | 131 | Alk Phos | 135 | Albumin | 39 |
| Platelets | 312 | AST | 25 | CRP | 1 |

Pharmacy has received a written order on a BC Cancer preprinted order for the LUAVERL protocol requesting the following:

Erlotinib 150 mg PO daily for 28 days

## Step 1: Verify Patient Identity

Has the patient been registered with BC Cancer? B.B. has a BC Cancer ID number (XX-12345) and is therefore a registered patient with BC Cancer.

Two identifiers can be used to confirm that the order was written for the correct patient: name (B.B.) and BC Cancer ID number (XX-12345) or Personal Health Number (PHN).

If the patient is dropping off the prescription in person, date of birth, allergy status and height and weight (if applicable) can also be confirmed at this time.

## Step 2: Confirm Protocol Matches Clinical Indication and Eligibility for Treatment

LUAVERL is a BC Cancer protocol currently in use for treatment of advanced Non-Small Cell lung cancer (NSCLC). The most current version of this protocol is found on the BC Cancer website. Before proceeding, ensure that you are referring to the most current version of the protocol and the preprinted order.

"AV" in the protocol name indicates that this is treatment for advanced, metastatic cancer. This information should be available in the chart. If a chart is not available, you may wish to contact the ordering prescriber to confirm that those written orders are consistent with the indication on the protocol.

In this example, B.B. is diagnosed with metastatic lung adenocarcinoma which is a non-small cell lung cancer (NSCLC).

The protocol eligibility section indicates that patients must have progressive disease on or after first- or second-line therapy for advanced NSCLC. B.B's medication history indicates that she was previously on carboplatin and gemcitabine (LUAVPG). Her disease progressed (worsened) after 4 cycles.

Is erlotinib Class I, or does it require CAP approval? The LUAVERL protocol indicates that erlotinib for second or third line treatment of metastatic NSCLC is Class I. This information can also be confirmed using the BC Cancer Benefit Drug List.

Erlotinib is being used as a second line agent for B.B., so it is considered Class I. Therefore, this protocol does not require any extra documentation regarding benefit status. If erlotinib had been prescribed for first line therapy, approval would have been required from the BC Cancer Compassionate Access Program (CAP) before the patient started treatment.

Because B.B is a registered patient with BC Cancer and is a resident of British Columbia, erlotinib, for treatment of her cancer is eligible for reimbursement through the BC Cancer Systemic Therapy Program.

## Step 3: Review Medical History

Medications, medical history, allergy status and pregnancy status should be reviewed if indicated.

According to B.B.'s PharmaNet profile, she is currently taking levothyroxine, allopurinol, ranitidine, ramipril and oxazepam. According to the drug interactions section of the

Cancer Drug Manual erlotinib monograph, H2-blockers may reduce erlotinib solubility by increasing pH (reducing therapeutic effect of erlotinib), and separating administration of the two drugs is recommended. The Lexicomp and Micromedex drug interaction databases also flag this interaction. The patient will need to be counselled on spacing the administration of her ranitidine and erlotinib, or discuss the feasibility of discontinuing the ranitidine with her family doctor. In this case, calls to the prescribers of ranitidine and erlotinib are not required. It is recommended the pharmacist inform them of the results of the drug interaction discussion with the patient and recommended instructions by email or fax communication. See Step 11 for the counselling details.

Her past medical history is otherwise unremarkable with no non-oncology conditions (such as active infection) or external surgeries or treatments that may conflict. She does not have any known allergies. She is not required to do a pregnancy test prior to start of her cancer drug therapy as she is considered “not of child bearing potential”.

## Step 4: Check Timing of Treatment

B.B. received her last treatment with LUAVPG on May 3. Her first dose of erlotinib will be on June 21, which will be Day 1 of Cycle 1 for this new treatment. The planned schedule is appropriate.

## Step 5: Determine Patient’s Body Surface Area (if applicable)

A BSA calculation is not necessary as erlotinib dosing is fixed and not based on BSA.

## Step 6: Check Appropriateness of Cancer Drug Dose(s)

The dose written for erlotinib is 150 mg daily, which is the correct starting dose according to the protocol.

## Step 7:  Review Laboratory Values

Lab tests are performed at various times throughout treatment, depending on the protocol. In this example, there are baseline tests (i.e., prior to the initiation of treatment), tests two weeks after initiation of therapy and tests before each subsequent visit. B.B. has lab results dated June 7. These baseline tests have been ordered, as

outlined in the protocol. The lab work is acceptable because it was drawn within 4 weeks (28 days) of starting treatment.

All of B.B's lab results are within normal limits so treatment can proceed as ordered.

## Step 8: Verify Appropriate Method of Drug Delivery

B.B. has no problems swallowing tablets, so erlotinib oral tablets are a suitable dosage form.

## Step 9: Monitor for Cancer Drug Toxicity

The pharmacist will provide and use the BC Cancer patient handout for erlotinib to counsel B.B. in Step 11. B.B. will be booked to return for assessment by the prescriber prior to Cycle 2. She is provided with contact information for the nursing line and pharmacy, and instructed to contact the cancer clinic with any concerns that may occur prior to the return appointment if needed.

The protocol *Dose Modifications* section suggests dose interruption or modification for rash, diarrhea and elevated liver enzymes. The protocol *Precautions* section gives information on severe skin toxicity, diarrhea, gastrointestinal perforation risk, and ocular disorders. The erlotinib patient handout and drug monograph list further common side effect information that can be used for monitoring toxicities and for counselling the patient on what to watch for.

## Step 10: Verify Protocol-Related Supportive Care Provided

The erlotinib monograph indicates that the emetogenic potential is rare. No antiemetic prescription is required. However, the ordering prescriber may prescribe an antiemetic if they feel the patient is at risk.

B.B. is quite anxious about nausea and vomiting because she had a lot of trouble with it during her previous cancer drug regimen and she also reports a history of motion sickness. Since there was no prescription for an antiemetic, the pharmacist contacts the prescriber and a prescription for prochlorperazine 10 mg every 4 to 6 hours as needed is provided to the patient's local community pharmacy.

## Step 11: Counsel Patient

Patients starting a new protocol require counselling to understand their new cancer medications. For oral medications, pharmacists are required to counsel at the time of dispensing.

The pharmacist provides and uses the BC Cancer patient handout for erlotinib to counsel B.B. regarding administration instructions, precautions and common side effects, including nausea/vomiting, diarrhea, skin rash, sore mouth and fatigue.

A drug interaction between ranitidine and erlotinib was flagged for discussion with B.B, and she is counselled to separate the administration of her twice daily ranitidine and once daily erlotinib by taking erlotinib at least 2 hours before or 10 hours after the ranitidine. B.B. is also counselled to avoid grapefruit and grapefruit juice because it can increase the serum erlotinib concentration by inhibiting CYP3A4 enzymes in the intestinal wall. The erlotinib patient handout and information on the drug interaction is given to her for her information and to also show her family doctor.

The counselling is documented per site procedures.

### Resources

**Drug Information for Patients**

Information for the patient on the above medication can be found on the BC Cancer website under:

- Erlotinib Patient Handout
- LUAVERL Patient Handout
- Nausea and Vomiting [Pharmacy Symptom & Side Effect Management Resource Guide]

The pharmacist is encouraged to review this information with the patient.

**Drug Information for Health Professionals**

The information for health professionals on the above medication can also be found on the BC Cancer website:

- LUAVERL Chemotherapy Protocol
- Erlotinib Drug Monograph

**Other Resources**

The Protocol and Individual Drug Patient Handouts often refer to additional symptom and side effect information found elsewhere on the BC Cancer website. Additional information and other handouts can be located by referencing the Pharmacy Symptom and Side Effect Management Resource Guide. Other patient specific handouts that may be useful for this patient could include:

- Cancer Drug Manual Appendix [Information for Patients]
    - Natural Health Products and Cancer Therapy
    - Sun Sensitivity and Sunscreens
- Coping with Cancer: Nutrition Information
    - Food Choices to Help Manage Diarrhea Caused by Cancer Treatment
    - Food Ideas for a Sore Mouth
    - Practical Tips to Help Manage Nausea
    - Food Ideas to Help with Decreased Appetite
- Coping with Cancer: Managing Symptoms & Side Effects
    - Nausea and Vomiting
    - Managing Fatigue (Tiredness)

# Subsequent Doses

## Cycle 2

B.B. returns on July 19 with a prescription for erlotinib 100 mg daily for 28 days. Her bloodwork was drawn that morning. You notice that she has a maculopapular rash on her face. She did not have any other problems related to her first cycle of treatment.

Her weight remains at 59 kg.

| Lab results – Jul 18 | |
|---|---|
| Bilirubin | 3 |
| Alk Phos | 124 |

| | |
|---|---|
| AST | 28 |
| LDH | 223 |

As this is a continuation of the previous treatment, reviewing the patient's cancer drug order can begin with timing of the treatment. This appointment has been scheduled 28 days from Day 1 of cycle 1 so the timing is appropriate.

When checking the dose for cycle 2, the pharmacist notes that the dose has been reduced to 100 mg daily. The prescriber's dictation reveals that the dose was reduced because the patient developed a maculopapular rash during cycle 1. B.B. started minocycline mid-cycle, but the rash progressed so she wants to try a reduced dose. The protocol indicates that rash may require treatment interruption and/or dose reduction. The dose reduction to 100 mg daily is consistent with the protocol recommendations for rash management.

Lab work is acceptable and within normal limits as specified in the protocol.

## Cycle 3

B.B. returned for consideration of cycle 3 on Aug 16. Her rash has improved considerably and her LFTs are normal.

Lab results – Aug 15

| | |
|---|---|
| Bilirubin | 5 |
| Alk Phos | 119 |
| AST | 27 |
| LDH | 241 |

B.B. is tolerating erlotinib well and her treatment is continued at the reduced dose of 100 mg daily for 28 days.

## Cycle 4

B.B. returned to clinic on Sep 13 for consideration of Cycle 4. A CT scan from the week prior showed evidence of tumor progression. Erlotinib was discontinued and further treatment with docetaxel was considered.

# Example Case Study 3: GIFOLFOX

The following example demonstrates that deviation from the protocol can occur.

A.C. (MRN 111222XXX) is a 43-year-old female, diagnosed with carcinoma of the sigmoid colon, previously treated with surgery and post-op chemotherapy (12 cycles of GIAJFL) completed in August of the previous year. She returns to clinic, now diagnosed with metastatic disease (hepatic involvement) and is scheduled for treatment with GIFOLFOX on March 12. Baseline blood tests were performed at an outside lab 3 weeks ago. A.C. is not taking any other medications.

Lab results - February 18

| | | | | | |
|---|---|---|---|---|---|
| WBC | 13.7 | Creatinine | 60 | Electrolytes | WNL* |
| ANC | 10.23 | Bilirubin | 20 | Ca, Mg | WNL |
| Hgb | 124 | AST | 40 | | |
| Platelets | 495 | Alk Phos | 203 | | |

(* Within Normal Limits)

## Step 1: Verify Patient Identity

Pharmacy has received a written order for the following:

Oxaliplatin 130 mg IV in 500 mL D5W over 2 hours
Leucovorin 600 mg IV in 250 mL D5W over 2 hours
Fluorouracil 600 mg IV bolus, after Leucovorin, THEN
Fluorouracil 3600 mg by continuous IV infusion over 46 hours

A.C's name, DOB and MRN number were confirmed on the order, as A.C. is returning for treatment.

Patient-specific information: double signed height 150 cm, weight 55 kg, as available in the chart from March 11 (see Height and Weight Measurement and Documentation Procedure).

## Step 2: Confirm Protocol Matches Clinical Indication and Eligibility for Treatment

GIFOLFOX is a BC Cancer protocol currently in use for second line palliative combination treatment of metastatic colorectal cancer. Before proceeding, ensure that the protocol version you are using is the most current.

This protocol has numerous eligibility criteria and cautions. The term colorectal encompasses both colon and rectal cancers. The cautions listed in the protocol do not apply to this patient. All other criteria are met as she now has metastatic adenocarcinoma of the sigmoid colon and this is her first treatment in the advanced setting (previous protocol GIAJFL). Therefore, A.C. is eligible for this protocol, based on her diagnosis.

This protocol involves treatment with a 46h continuous IV infusion of fluorouracil every two weeks, physicians generally order a central venous access device insertion prior to treatment. A.C. has already had her central line (PORT-a-Cath) inserted and is ready for Cycle 1.

## Step 3: Review Medical History

Medications, medical history, allergy status and pregnancy status should be reviewed if indicated.

A.C. is not taking any other medications. Her past medical history is otherwise unremarkable with no non-oncology conditions (such as active infection) or external surgeries or treatments that may conflict.

A.C. has a history of severe latex allergy. All her medications must be prepared following the Provincial Pharmacy Directive VI-70: Guidelines for Preparation of Parenteral Hazardous Drugs for Latex Allergy Patients [SHOP]. Her latex allergy must be documented on her medical record and pharmacy file, as well as on all pharmacy labels used for preparation and dispensation of her IV drugs.

She will need to have a negative pregnancy test confirmed or be assessed as not being of “child bearing potential” prior to start of her cancer drug treatment (see Pregnancy Assessment and Education for Systemic Therapy Patients Procedure: V220).

## Step 4: Check Timing of Treatment

A.C. has received treatment in the past, which was completed 6 months prior. This is her first cycle of treatment for relapse. Her first treatment date will be March 12.

## Step 5: Determine Patient's Body Surface Area

Calculate the patient's body surface area:

$$\text{BSA } (m^2) = \sqrt{\frac{height(cm) \times weight(kg)}{3600}}$$

$$= \sqrt{\frac{150cm \times 55kg}{3600}}$$

$$= 1.51\ m^2$$

## Step 6: Check Appropriateness of Cancer Drug Dose(s)

Calculation of doses for Cycle 1:

Oxaliplatin: 85 mg/$m^2$ × 1.51 $m^2$ = 128 mg
Leucovorin: 400 mg/$m^2$ × 1.51 $m^2$ = 604 mg
Fluorouracil bolus: 400 mg/$m^2$ × 1.51 $m^2$ = 604 mg
Fluorouracil infusion: 2400 mg/$m^2$ x 1.51 $m^2$ = 3624 mg

These calculated doses are within 5% of the doses ordered by the prescriber so are acceptable, as per Systemic Therapy Treatment Delivery Process Policy: III-10 [SHOP]. If there was a variance of greater than 5%, the prescriber must be contacted and the discrepancy resolved. The order will be processed as written by the prescriber. Note: If dose banding is used, the infusional fluorouracil will be dispensed in a Baxter LV5 Infusor® containing 3600 mg of fluorouracil.

Doses administered should be documented on the patient chart, as well as on the pharmacy treatment record.

The patient is not receiving a drug with a recommended maximum cumulative dose.

## Step 7: Review of Laboratory Values

Lab work for current treatment is from 3 weeks ago. In accordance with BC Cancer Systemic Therapy Treatment Delivery Process Policy: III-10 [SHOP]. The lab work is acceptable because it was drawn within 4 weeks (28 days) of starting treatment.

A.C.'s lab results are within the guidelines of this protocol and treatment can proceed as ordered. WBC and ANC counts were slightly high but her vitals including temperature were checked to ensure she did not have an infection prior to starting chemotherapy.

As A.C. has already been treated with fluorouracil in the adjuvant setting and tolerated it, DPYD testing is not part of the baseline testing for this patient.

## Step 8: Verify Appropriate Method of Drug Delivery

Prepare and administer as per protocol, following sterile technique and safe handling procedures for hazardous drugs. As per protocol, oxaliplatin and leucovorin are administered in D5W and may be given concurrently by using a Y-site connector placed immediately before the injection site. Oxaliplatin and leucovorin cannot be combined in the same bag, and oxaliplatin is not compatible with NS, as per the ***Chemotherapy Preparation and Stability Chart*** [Cancer Drug Manual]. The first fluorouracil is given as IV push, and the second dose is given as a 46-hour infusion. The GIFOLFOX preprinted orders indicate that BC Cancer uses Baxter LV5 infusors™ to infuse fluorouracil for this protocol.

The drug formulations and devices used for this patient will have to be assessed for latex content prior to mixing per usual site procedures. Refer to Provincial Pharmacy Directive VI-70: Guidelines for Preparation of Parenteral Hazardous Drugs for Latex Allergy Patients [SHOP].

## Step 9: Monitor for Potential Cancer Drug Toxicity

### Leucovorin

As part of the protocol, leucovorin plays a supportive role in treatment. Read the ***Protectants*** section of the pharmacy Supportive Care module [Clinical Pharmacy Guide – Modules – Module 5] for more information.

# Step 10: Verify Protocol-Related Supportive Care Provided

## Anti-emetics

GIFOLFOX is classified as "Moderately Emetogenic Chemotherapy (MEC)" as per the updated BC Cancer Supportive Care Protocol SCNAUSEA. Ondansetron and dexamethasone are indicated as premedication, and the patient should have been given a prescription for these drugs to be filled at a community retail pharmacy. Prochlorperazine, metoclopramide, and olanzapine may also be prescribed for this patient. Read the ***Antiemetics*** section of the pharmacy Supportive Care module [Clinical Pharmacy Guide - Modules – Module 5] for more information. Supportive care medications are not reimbursed by BC Cancer, and should be obtained from a community retail pharmacy.

## Loperamide

Both oxaliplatin and fluorouracil have the potential to cause diarrhea. When used in combination, this potential increases. Loperamide may be an option for this patient. Supportive care medications are not reimbursed by BC Cancer, and should be obtained from a community retail pharmacy. See the BC Cancer pharmacy Drug Funding web page for more information.

# Step 11: Counsel Patient

Patients starting a new protocol require counselling to understand their new cancer medications. For oral medications, pharmacists are required to counsel at the time of dispensing. This patient is starting parenteral medications only. Depending on the cancer centre or CON site, usually a nurse will counsel patients about their parenteral medications.

## Resources

**Drug Information for Patients**

Information for the patient on the above medications can be found on the BC Cancer website under:

- GIFOLFOX Patient Handout

- Fluorouracil INFUSOR™ Patient Handout (Your Infusor – A Guide for Patients)
- Cancer Drug Manual Individual Patient Handouts [Drug Index]:
    - Oxaliplatin
    - Leucovorin
    - Fluorouracil
    - Ondansetron
    - Metoclopramide
    - Prochlorperazine
    - Dexamethasone
- Nausea and Vomiting [Pharmacy Symptom & Side Effect Management Resource Guide]

**Drug Information for Health Professionals**

Information on the GIFOLFOX protocol and drugs can be found for health professionals on the BC Cancer website under:

- GIFOLFOX Protocol
- Cancer Drug Manual
    - Chemotherapy Preparation & Stability Charts
    - Drug Index - Individual Drug Monographs
        - Oxaliplatin
        - Leucovorin
        - Fluorouracil (5-FU)
        - Ondansetron
        - Metoclopramide
        - Prochlorperazine
        - Dexamethasone
- Pharmacy FAQs > Elastomeric Infusors for fluorouracil (5-FU)

**Other Resources**

The Protocol and Individual Drug Patient Handouts often refer to additional symptom and side effect information found elsewhere on the BC Cancer website. Additional information and other handouts can be located by referencing the Pharmacy Symptom and Side Effect Management Resource Guide. Other patient specific handouts that may be useful for this patient could include:

- Cancer Drug Manual Appendix [Information for Patients]

    - Natural Health Products and Cancer Therapy
    - Sun Sensitivity and Sunscreens
- Coping with Cancer: Nutrition Information
    - Food Choices to Help Manage Diarrhea Caused by Cancer Treatment
    - Food Ideas for a Sore Mouth
    - Food Ideas to Help with Decreased Appetite
    - Practical Tips to Help Manage Nausea
- Coping with Cancer: Managing Symptoms & Side Effects
    - Nausea and Vomiting
    - Managing Fatigue (Tiredness)
- Safe Handling handouts are available and should be provided to this patient as they are receiving a Group 1 Hazardous Drug:
    - Cancer Drug Manual [Safe Handling]
        - Guidelines for Handling Cancer Drugs and Body Fluids in the Home
- As this patient is of childbearing potential, the following handout may also be useful:
    - Preventing Pregnancy during Cancer Treatment

# Subsequent Doses

## Cycle 3: April 9

A.C. returns for her third cycle of treatment. Her previous treatment was on March 26. She has been troubled with diarrhea and mucositis. Since the patient has been heavily pretreated with 5-FU, the prescriber has decided to reduce the 5-FU dose by one dose level. She is experiencing grade 2 level peripheral neuropathy and pharyngeal dysesthesia as well. According to the protocol dose modifications, the dose of oxaliplatin should be decreased by one dose level. However, based on patient-specific factors and clinical experience, the prescriber decides to continue at the present oxaliplatin dose. The pharmacist contacts the prescriber to confirm this deviation in protocol (as it was not clearly explained in the prescriber's clinic note) and documents this information on the pharmacy treatment record and the patient chart.

| Lab results – April 8 | | | | | |
|---|---|---|---|---|---|
| WBC | 7.7 | Bilirubin | 8 | Electrolytes | WNL |

| | | | | | |
|---|---|---|---|---|---|
| ANC | 3.44 | AST | 41 | Ca, Mg | WNL |
| Hgb | 126 | Alk Phos | 69 | | |
| Platelets | 185 | Creatinine | 70 | | |

Her current weight is 51.8 kg, her doses still fall within 5% of the doses ordered and her weight change was not greater than 10% from cycle 1. As per Systemic Therapy Treatment Delivery Process Policy: III-10 [SHOP], the prescriber has chosen to keep using the same BSA (1.51 $m^2$) as previously calculated. Pharmacy receives the following orders:

Oxaliplatin 130 mg IV in 500 mL D5W over 2 hours
Leucovorin 600 mg IV in 250 mL D5W over 2 hours
Fluorouracil 480 mg IV bolus
Fluorouracil 3000 mg continuous IV infusion over 46 hours

Calculated doses are as follows:

Oxaliplatin: 1.51 $m^2$ x 85 mg/$m^2$ = 128 mg
Leucovorin: 1.51 $m^2$ x 400 mg/$m^2$ = 604 mg
Fluorouracil: 1.51 $m^2$ x 320 mg/$m^2$ = 483 mg
Fluorouracil infusion: 1.51 $m^2$ x 2000 mg/$m^2$ = 3020 mg

These calculated doses are within 5% of ordered doses, therefore are acceptable. Doses can be prepared as ordered by the prescriber and administered to patient. If dose banding is used the infusional fluorouracil will be dispensed in a Baxter LV5 Infusor® containing 3200 mg of fluorouracil.

## Cycle 5: May 21

A.C. returns for consideration of her 5$^{th}$ cycle of treatment. Her previous treatment was on April 23, and one week following this treatment she was hospitalized for severe abdominal pain, diarrhea, nausea and vomiting, with mild dehydration. She remained in hospital for over one week. Her treatment for May 7 was cancelled as a result. On May 21, her neurotoxicity is at grade 3 and, according to the protocol, oxaliplatin should be discontinued. Again, based on clinical experience and patient-specific factors, the prescriber makes the decision to continue oxaliplatin treatment, but at one dose level lower than before. The prescriber also feels that her hospitalization was due to fluorouracil toxicity, and therefore, decreases the dose of fluorouracil by another dose

level. The pharmacist contacts the prescriber to confirm these deviations in protocol (as it was not clearly explained in the prescriber's clinic note) and documents this information on the pharmacy treatment record.

Lab results – May 20

| | | | | | |
|---|---|---|---|---|---|
| WBC | 15.5 | Creatinine | 50 | Electrolytes | WNL |
| ANC | 9.3 | Bilirubin | 12 | Ca, Mg | WNL |
| Hgb | 116 | ALT | 42 | | |
| Platelets | 330 | Alk Phos | 72 | | |

Pharmacy receives the following orders:

Oxaliplatin 98 mg IV in 250 mL D5W over 2 hours
Leucovorin 600 mg IV in 250 mL D5W over 2 hours
Fluorouracil 300 mg IV bolus
Fluorouracil 2400 mg continuous IV infusion over 46 hours

Calculated doses are as follows:

Oxaliplatin: 1.51 $m^2$ x 65 mg/$m^2$ = 98.2 mg
Leucovorin: 1.51 $m^2$ x 400 mg/$m^2$ = 604 mg
Fluorouracil: 1.51 $m^2$ x 200 mg/$m^2$ = 302 mg
Fluorouracil infusion: 1.51 $m^2$ x 1600 mg/$m^2$ = 2416 mg

All calculated doses are within 5% of written orders; therefore drugs can be prepared and administered as ordered. As the infusional dose of fluorouracil is less than 3000 mg, BC Cancer Pharmacy will mix the dose as prescribed and a premixed banded dose is not used as per protocol.

## Cycle 6: June 3

A.C. returns for consideration of her 6$^{th}$ cycle. She continues to experience Grade 3 neurotoxicity with severe impairment of daily living activities. She decides with the prescriber to discontinue oxaliplatin. The prescriber also changes the leucovorin to IV push. As per the protocol, if oxaliplatin is omitted leucovorin can be given at a lower dose via IV push. The prescriber decides to keep fluorouracil doses the same as in the previous cycle. The rationale for these changes is documented in the prescriber's note. The pharmacist proceeds with the orders as written.

| Lab results – Jun 2 | | | | | |
|---|---|---|---|---|---|
| WBC | 3.2 | Creatinine | 53 | Electrolytes | WNL |
| ANC | 2.1 | Bilirubin | 10 | Ca, Mg | WNL |
| Hgb | 110 | ALT | 41 | | |
| Platelets | 210 | Alk Phos | 70 | | |

Pharmacy receives the following orders:

Leucovorin 30 mg IV push
Fluorouracil 300 mg IV bolus
Fluorouracil 2400 mg continuous IV infusion over 46 hours

Calculated doses are as follows:

Leucovorin: 1.51 $m^2$ x 20 mg/$m^2$ = 30.2 mg
Fluorouracil: 1.51 $m^2$ x 200 mg/$m^2$ = 302 mg
Fluorouracil infusion: 1.51 $m^2$ x 1600 mg/$m^2$ = 2416 mg

All calculated doses are within 5% of written orders, therefore, the drugs can be prepared and administered as ordered. As the dose of infusional 5-FU is less than 3000 mg, BC Cancer Pharmacy will mix the dose as prescribed and a premixed banded dose is not used as per protocol.

## Cycle 7: June 17

A.C. returns for consideration of her 7$^{th}$ cycle. She is nauseous, dehydrated and feeling "rotten". A CT scan of the liver reveals significant disease progression compared with previous CT scan of March. A.C. does not feel she has the strength to face further treatment and agrees to a palliative care consultation. Cancer drug treatment is discontinued.