ALERT
Don appropriate personal protective equipment (PPE) based on the patient’s signs and symptoms and indications for isolation precautions.

Refer to Oncology Nursing Society (ONS) interim guidelines for PPE recommendations during an emergent shortage of PPE (e.g. pandemic).

Acute neurologic changes, such as headache, nausea, vomiting, seizures, confusion, lethargy, and altered mental status, after intrathecal antineoplastic drug administration may result from increased intracranial pressure (ICP) and warrant immediate evaluation, diagnosis, and management.

Only qualified physicians, physician assistants, advanced practice registered nurses (APRNs), or nurses with demonstrated competency administer antineoplastic therapies. Refer to the professional’s regulatory scope of practice and the organization’s practice.

Take steps to eliminate interruptions and distractions during medication preparation.

OVERVIEW
Intrathecal antineoplastic therapy is commonly used to treat primary and metastatic central nervous system (CNS) malignancies and meningeal carcinomatosis. It can also be used to prevent CNS involvement of hematologic malignancies, such as acute lymphoblastic leukemia. This directed therapy provides drug penetration into the brain or spinal cord via a lumbar puncture (LP) anywhere along the spinal axis or through an Ommaya reservoir implanted in the ventricles of the brain. Commonly used intrathecal antineoplastic agents include cytarabine (Ara-C), methotrexate, thiotepa, and corticosteroids. Preservative-free medications are required for intrathecal administration, and all medications used should be labeled as such.

Intrathecal antineoplastic therapy is concentrated to minimize the amount of fluid instilled into the cerebrospinal fluid (CSF) and to prevent increased ICP.

<table>
<thead>
<tr>
<th>Box 1 Commonly Used Intrathecal Antineoplastic Drugs</th>
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<tbody>
<tr>
<td>• Cytarabine</td>
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<tr>
<td>• Hydrocortisone</td>
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<tr>
<td>• Liposomal cytarabine</td>
</tr>
<tr>
<td>• Methotrexate</td>
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<tr>
<td>• Thiotepa</td>
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</tbody>
</table>


Both intrathecal delivery methods (LP and Ommaya reservoir) permit the withdrawal of CSF specimens for laboratory analysis and pressure monitoring as well as the administration of the antineoplastic agent. With LP, a risk of medication leakage from the CSF into the epidural space exists even when CSF return is confirmed. The Ommaya reservoir is more commonly used when repeated medication administration
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is required and provides more consistent drug distribution. The Ommaya reservoir is a surgically implanted intraventricular device that lies beneath the skin of the scalp over the patient's nondominant frontal lobe with a catheter threaded from the dome into the ventricle. With LP, access is made with a special spinal needle along the spinal axis, and medication administration may occur immediately after access is achieved. With an Ommaya reservoir, an x-ray is required to confirm placement, and medication administration may begin within 48 hours of placement.

Although intrathecal administration minimizes systemic effects from antineoplastic therapy, complications can result and are commonly neurotoxic. Chemical aseptic meningitis, or arachnoiditis, occurs most often. Signs and symptoms are consistent with those of increased ICP: headache, nausea and vomiting, photophobia, altered mental status, and fever. Postsurgical complications from Ommaya reservoir placement include intracranial or intraventricular hemorrhage, infection, and equipment failure. Aseptic or chemical meningitis may occur hours to days after intrathecal drug administration. Therefore, nursing care after intrathecal antineoplastic drug administration requires patient monitoring for expected adverse effects and neurologic complications to ensure early identification and prompt intervention.

To minimize the chance of a medication error, the practitioner should write orders for intrathecal medications on standardized, preprinted, or electronic forms. These forms should be separate forms, not those used for IV drug therapies. A drug intended for delivery via the intrathecal route should not be prepared at the same time as any other agent, and once prepared, it should be stored in an isolated container or location with a distinctly identifiable label, and it should be transported only with additional medications intended to be administered via the intrathecal route.

As a best-practice strategy to minimize the risk of error and to avoid confusion, agents such as vincristine, which are fatal if delivered intrathecally, should be prepared in minibags when given via the IV route instead of in a syringe.

The practitioner should be specially trained in administering intrathecal drugs and should administer such drugs only in a designated setting after a double-check verification by two specially trained oncology practitioners or personnel. Taking such steps helps reduce the risk of potentially fatal medication errors.

If the patient expresses concern regarding the accuracy of an intrathecal antineoplastic medication, the medication should not be given. The concern should be explored, the practitioner notified, and the order verified.

EDUCATION

- Provide developmentally and culturally appropriate education based on the desire for knowledge, readiness to learn, and overall neurologic and psychosocial state.
- Assess the patient and caregiver for readiness to learn, comprehension level, and language barriers.
- Explain the rationale for intrathecal administration according to the patient's diagnosis and prescribed treatment plan.
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- Individualize antineoplastic drug education for the agent or agents to be administered with an emphasis on the expected number of doses, frequency, adverse effects, and potential complications. Provide written information.
- Provide education regarding the specific intrathecal procedure and explain postprocedure restrictions that reduce the risk of meningeal irritation.
- If an Ommaya reservoir is used, explain that the patient may resume normal activities; however, caution should be taken to prevent injury to the reservoir site.
- Instruct the patient and caregiver to notify the appropriate practitioner of signs and symptoms of infection and other possible complications (Box 2).

<table>
<thead>
<tr>
<th>Box 2 Signs and Symptoms of Infection and Other Complications of Intrathecal Antineoplastic Drug Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Inability to maintain oral intake</td>
</tr>
<tr>
<td>• Light sensitivity (e.g., photophobia)</td>
</tr>
<tr>
<td>• Prolonged nausea and vomiting occurring spontaneously and accompanying headache</td>
</tr>
<tr>
<td>• Neck stiffness or pain</td>
</tr>
<tr>
<td>• New bleeding or bruising</td>
</tr>
<tr>
<td>• Redness, tenderness, or drainage at site of drug administration (e.g., lumbar, Ommaya reservoir)</td>
</tr>
<tr>
<td>• Severe, intractable headache</td>
</tr>
<tr>
<td>• Temperature of 38°C (100.4°F) or higher, which may indicate infection</td>
</tr>
</tbody>
</table>

(Data from M. Olsen, K.B. LeFebvre, K. Brassil (Eds.), Chemotherapy and immunotherapy guidelines and recommendations for practice. Pittsburgh: Oncology Nursing Society; D. Camp-Sorrell, L. Matey. [2017]. Access device standards of practice for oncology nursing. Pittsburgh: Oncology Nursing Society.)

- Instruct the patient to notify the nurse immediately of toxic reactions, such as pain, headache, shortness of breath, and chest heaviness during drug administration.
- Instruct the patient regarding the potential side effects and adverse reactions to the medication.
- Instruct the patient and caregiver to alert the practitioner if adverse effects or signs and symptoms of infection occur.
  - Fever of 38°C (100.4°F) or higher
  - Persistent nausea and vomiting
  - Diarrhea or constipation
  - Intolerance to food
  - Decreased urine output
  - Change in mental status
  - New bleeding or bruising
- Instruct the patient and caregiver on the importance of keeping appointments for laboratory tests and clinical examinations.
- Instruct the patient and caregiver on drug-specific acute and long-term toxicities and self-care measures to manage them.
- Discuss the goals of therapy and the measurement of responses.
- Discuss fertility issues with patients of childbearing age.
- Discuss safe handling issues with all patients receiving antineoplastic therapy.
- Encourage questions and answer them as they arise.
ASSESSMENT AND PREPARATION

Assessment
1. Perform hand hygiene and don PPE as indicated for needed isolation precautions.
2. Introduce yourself to the patient.
3. Verify the correct patient using two identifiers.
4. Obtain the patient’s history.
   a. Type of cancer
   b. Previous cancer treatments and associated toxicities including episodes of hypersensitivity
   c. Tolerance of cancer treatment and self-care activities
   d. Comorbidities and current medications, particularly those that may increase bleeding risk
5. Assess the patient’s vital signs and the location of any pain.
6. Perform a physical examination with an emphasis on neurologic and mental status to establish baseline measures.
7. Assess the patient’s willingness to undergo intrathecal drug administration.
8. Assess the patient’s laboratory test results before therapy, particularly those indicating coagulopathy status.
9. Assess the patient for specific contraindications to receiving the prescribed drug and advise the practitioner accordingly.
10. Assess the administration site for abnormalities, such as redness, rash, or infection.
11. Obtain the patient’s current height and weight for use in determining the drug dose.

Preparation
1. Verify the patient’s actual admission weight in kilograms. Reweight the patient if appropriate. 8 Stated, estimated, or historical weight should be not used. 8 Obtain the patient’s height.
2. Recalculate drug doses based on weight before each new cycle of antineoplastic therapy.

   Rationale: Doses of some antineoplastic agents are based on body surface area (BSA). Accurate measurement of the patient’s height and weight is needed to perform this calculation. Patients may underestimate or overstate their height and weight, so measurements must be performed.

3. Obtain the medication, check the practitioner’s order, verify the expiration date, and inspect the medication for particulates, discoloration, or other loss of integrity.

   Do not use any medication that is cloudy or precipitated unless such is indicated by its manufacturer as being safe.
4. Review medication reference information pertinent to the medication’s action, purpose, onset of action and peak action, normal dose, and common side effects and implications.
5. Administer antiemetic and analgesic medications as prescribed up to 30 minutes before the procedure.
6. Reassess the patient’s pain status, allowing for sufficient onset of action per medication, route, and the patient’s condition.

a. Use a standardized list to verify that all required items, including informed consent, are available.
b. Mark the procedure site when required.

PROCEDURE
Assisting with a Lumbar Puncture (LP) and Intrathecal Antineoplastic Administration

1. Perform hand hygiene and don gloves and appropriate PPE based on the patient’s signs and symptoms and indications for isolation precautions. Use the ONS interim guidelines for PPE recommendations during an emergent shortage of PPE (e.g., pandemic) (Table 1).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Oncology Nursing Society (ONS) Recommendations and Interim Guidelines for Personal Protective Equipment (PPE) Use During Pandemic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PPE</strong></td>
<td><strong>ONS recommendations</strong></td>
</tr>
</tbody>
</table>
| Gown | Disposable poly-coated gown | • Regular disposable gown (water resistant)  
• Cloth gown (facility laundered) for infection control and nonhazardous drugs |
| Mask | Mask with face and eye protection required only if splashing likely and for spill cleanup | • N95 mask for symptomatic or patients with COVID-19 and hazardous drug spills and cleanup  
• PAPR |
| Eye protection | Mask with eye protection or goggles if splashing likely or spill cleanup | • Full facepiece air-purifying respirator or PAPR |
| Gloves | Double chemotherapy-tested gloves | • Single chemotherapy-tested gloves  
• Double standard examination gloves  
• Single standard examination gloves |
| Shoe covers | Only in area for compounding hazardous drugs | • Work-only, washable shoes |

COVID, coronavirus; PAPR, powered air purifying respirator; PPE, personal protective equipment  
*Highest-level recommended practice based on supplies of available PPE  
2. When no shortage exists, don two pairs of gloves tested and approved for use with chemotherapy, an impervious solid-front long-sleeve chemotherapy-resistant gown, mask, and face shield or eye protection.

   Use maximum sterile barrier precautions and antineoplastic PPE, which includes two pairs of chemotherapy gloves, an impervious solid-front long-sleeve chemotherapy-resistant gown, mask, and face shield or eye protection.\(^\text{14}\)

3. Two practitioners or personnel approved to prepare or administer antineoplastic therapies verify the patient using two identifiers, confirm with the patient the planned treatment, and verify the drugs’ name, dose, volume, rate and route of administration, expiration dates and times, and appearance and integrity of the drugs.

   Antineoplastic drugs and other medications injected intrathecally must be preservative free because of the risk of neurotoxicity and anaphylaxis.\(^\text{3}\)

4. Explain the procedure to the patient and ensure that he or she agrees to treatment.
5. Ensure the six rights of medication safety: right medication, right dose, right time, right route, right patient, and right documentation. Use a bar code system or compare the medication administration record to the patient’s identification band.
6. Label all medications, medication containers, and other solutions, including those that are on a sterile field. The only exceptions are medications that are still in their original container or medications that are administered immediately by the person who prepared them.\(^\text{10}\)
7. For high-risk medications delivered via an epidural, intrathecal, or arterial route: Label the catheter and do not use tubing or catheters that have injection ports. Implement an independent double-check procedure during the delivery of high-risk medications.\(^\text{2}\)

   Ensure that intrathecal antineoplastic medication is labeled *For Intrathecal Use Only. Do not remove any external packaging until immediately before administration.*\(^\text{14}\)

8. Use distinctly different pumps for IV applications (rather than using similar pumps for intrathecal and epidural applications).\(^\text{2}\)

   Rationale: Using distinctly different pumps reduces the possibility that an intrathecal medication will accidentally be delivered intravenously and vice versa.

   Some types of chemotherapy, including plant (vinca) alkaloids (e.g., vinblastine, vincristine, vinorelbine), the antitumor antibiotic mitoxantrone, and the targeted therapy agent bortezomib are fatal if given intrathecally. Exercise extreme caution to ensure that these drugs are not accidentally given by this route.\(^\text{14}\)
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10. For the administration of intrathecal antineoplastic drugs, use only syringes, needles, and other devices with non-Luer connectors that cannot connect to IV devices.2

11. Place the patient in the lateral decubitus position on a firm surface with a pillow under his or her head and his or her chin and legs flexed toward the chest. Alternatively, have the patient sit forward supported by a table and the nurse.

   Rationale: This position ensures spinal alignment for proper CSF access.

12. Prepare the LP tray for the procedure, including a 22-G atraumatic needle, CSF collection tubes, preservative-free anesthetic solution (e.g., 1% lidocaine), preservative-free 0.9% sodium chloride solution, and syringes.4

   Ensure that Vacutainer® tubes are not used to remove CSF because they create high pressure during aspiration, which can lead to patient complications.

13. Remove gloves, perform hand hygiene, and don two pairs of sterile chemotherapy gloves while maintaining other PPE.

   Accessing the intrathecal space is a sterile procedure, and sterile precautions must be maintained.

14. Assist with cleansing the area of insertion with an organization-approved antiseptic, if requested.

   Rationale: Antiseptic cleansing minimizes the risk of infection and protects the insertion site from recontamination.

   The product insert for chlorhexidine warns against its use before LP and says that contact with the meninges should be avoided.16 However, a number of studies have concluded that it is safe to use.15 Total protein in the CSF can show a false high elevation from contamination by povidone-iodine using the benzethonium chloride (BZTC) or pyrogallol red (PGR) method.7

15. Assist with applying the sterile towels or barrier.

16. Place a plastic-backed absorbent pad under the spinal axis access site.14

   Rationale: This plastic-backed absorbent pad helps reduce contamination of underlying surfaces during antineoplastic intrathecal drug administration.

17. Assist with patient positioning as needed to ensure proper needle placement.

18. Assist with collecting CSF specimens as indicated; apply the appropriate patient label, date, and time. Note the color and clarity of the CSF.
Rationale: Clear CSF may indicate the absence of infection; cloudiness may indicate bacterial infection. A yellow, pink, or reddish color may indicate viral infection.

19. Ensure verification of intrathecal access and completion of the antineoplastic drug-verification process before the practitioner administers the drug.
20. Cleanse the area with an organization-approved antiseptic solution and place a dry sterile dressing.
21. Keep the patient in a comfortable position to reduce the risk of meningeal irritation.
22. In the presence of the patient, label the specimen per the organization’s practice. 10
23. Place the labeled specimen in a biohazard bag and transport it to the laboratory immediately per the organizations practice.
24. Discard supplies, remove PPE and place it in a designated hazardous waste container, and perform hand hygiene.

Assisting with an Ommaya Reservoir Access and Intrathecal Antineoplastic Administration 3
1. Perform hand hygiene and don gloves and appropriate PPE based on the patient’s signs and symptoms and indications for isolation precautions. Use the ONS interim guidelines for PPE recommendations during an emergent shortage of PPE (e.g., pandemic) (Table 1). 13
2. When no shortage exists, don two pairs of gloves tested and approved for use with chemotherapy, an impervious solid-front long-sleeve chemotherapy-resistant gown, mask, and face shield or eye protection.

   Use maximum sterile barrier precautions and antineoplastic PPE, which includes two pairs of chemotherapy gloves, an impervious solid-front long-sleeve chemotherapy-resistant gown, mask, and face shield or eye protection. 14

3. Two practitioners or personnel approved to prepare or administer antineoplastic therapies verify the patient using two identifiers, confirm with the patient the planned treatment, and verify the drug name, dose, volume, rate and route of administration, expiration dates and times, and appearance and integrity of the drugs.

   Antineoplastic drugs and other medications injected intrathecally must be preservative free because of the risk of neurotoxicity and anaphylaxis. 8

4. Explain the procedure to the patient and ensure that he or she agrees to treatment.
5. Ensure the six rights of medication safety: right medication, right dose, right time, right route, right patient, and right documentation. Use a bar code system or compare the medication administration record to the patient’s identification band.
6. Label all medications, medication containers, and other solutions. The only exceptions are medications that are still in their original container or medications that are administered immediately by the person who prepared them.  
7. For high-risk medications delivered via an epidural, intrathecal, or arterial route: Label the catheter and do not use tubing or catheters that have injection ports. Implement an independent double-check procedure during the delivery of high-risk medications. 

Ensure that intrathecal antineoplastic medication is labeled For Intrathecal Use Only. Do not remove any external packaging until immediately before administration.

8. Use distinctly different pumps for IV applications (rather than using similar pumps for intrathecal and epidural applications).

Rationale: Using distinctly different pumps reduces the possibility that an intrathecal medication will accidentally be delivered intravenously and vice versa.

Some types of chemotherapy, including plant (vinca) alkaloids (e.g., vinblastine, vincristine, vinorelbine), the antitumor antibiotic mitoxantrone, and the targeted therapy agent bortezomib (Velcade), are fatal if given intrathecally. Exercise extreme caution to ensure that these drugs are not accidentally given by this route.

10. For the administration of intrathecal antineoplastic drugs, use only syringes, needles, and other devices with non-Luer connectors that cannot connect to IV devices.
11. Place the patient in a reclining or sitting position.
12. Remove gloves, perform hand hygiene, and don two pairs of sterile chemotherapy gloves while maintaining other PPE.

Accessing the intrathecal space is a sterile procedure, and sterile precautions must be maintained.

13. Prepare the site by clipping (not shaving) hair, if applicable.
14. Assist the practitioner as needed with cleansing the patient’s scalp using an organization-approved antiseptic solution (e.g., povidone iodine, chlorhexidine-based solution).

Rationale: Antiseptic cleansing minimizes the risk of infection and protects the insertion site from recontamination.

The product insert for chlorhexidine warns against its use before LP and says that contact with the meninges should be avoided. However, a number of studies have concluded that it is safe to use. Total protein in the CSF can show a false high
15. Assist with applying the sterile drape. Ensure that access supplies are present, including a 25-G or smaller needle to preserve the integrity of the reservoir dome.  
16. Place a plastic-backed absorbent pad under the reservoir access site, when possible.  

Rationale: This plastic-backed absorbent pad helps reduce contamination of underlying surfaces during antineoplastic intrathecal drug administration.

17. Assist the practitioner as needed with accessing the Ommaya reservoir.  
18. Monitor the patient’s position during the procedure.  
19. Assist the practitioner as needed with collecting specimens.

Ensure that Vacutainer tubes are not used to remove CSF because they create high pressure during aspiration, which can lead to patient complications.

20. Ensure that verification of intrathecal access and reverification of the drug to be administered are completed before the practitioner administers the drug.  
21. Cleanse the area with an organization-approved antisepctic solution and place a dry sterile dressing.  
22. Keep the patient in a comfortable position to reduce the risk of meningeal irritation.  
23. In the presence of the patient, label the specimen per the organization’s practice.  
24. Place the labeled specimen in a biohazard bag and transport it to the laboratory immediately per the organizations practice.  
25. Discard supplies, remove PPE and place it in a designated hazardous waste container, and perform hand hygiene.  

MONITORING AND CARE
1. Keep the patient in a supine or semirecumbent position for at least 30 minutes after the procedure.  
2. Monitor the patient’s neurologic status for signs and symptoms of increased ICP during and at least every 4 hours after the procedure.  
3. Monitor vital signs after the procedure and during any complication that occurs.  
4. Monitor the patient for adverse and allergic reactions to the medication. Recognize and immediately treat respiratory distress and circulatory collapse, which are signs of a severe anaphylactic reaction. Follow the organization’s practice for emergency response.  
5. Monitor the intrathecal site for signs of infection.  
6. Monitor the patient for signs of a systemic infection or meningitis.  
7. Promote adequate hydration.  
8. Administer antipyretics as prescribed to maintain normothermia.  
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10. Monitor the patient’s position after the procedure to prevent meningeal irritation.

EXPECTED OUTCOMES
- Medication administered per the six rights of medication safety
- Successful specimen collection
- No increased ICP
- No meningeal irritation
- No site infection
- No systemic infection
- No hematoma formation

UNEXPECTED OUTCOMES
- Medication not administered per the six rights of medication safety
- Increased ICP
- Change in vital signs (respiratory changes, bradycardia, or increased systolic blood pressure)
- Meningeal irritation
- Site infection
- Systemic infection
- Inability to collect specimen
- Inability to administer medication
- Hematoma formation

DOCUMENTATION
- Time-out procedure, including verification of the correct patient, correct procedure, and correct site
- Education and response to education
- Patient’s tolerance of the procedure
- Patient’s response to the medication, including adverse reactions
- Patient’s weight in kilograms per the organization’s practice
- CSF description, including color and clarity, amount withdrawn, and laboratory specimens sent
- Medications administered, including antiemetics, analgesics, and anesthetics
- Appearance of the insertion site before and after the procedure
- Psychosocial support provided
- Unexpected outcomes and related interventions

SPECIAL CONSIDERATIONS
- For pediatric patients undergoing LP, emergency equipment should be nearby because they are at risk of airway compromise that can lead to cardiopulmonary decompensation.
- Pediatric patients undergoing LP may be asked to lie flat for several hours after the procedure to reduce the risk of postprocedure headache.
- Older adults who have difficulty maintaining positions for LP may require additional time or repositioning.
REFERENCES


Antineoplastic Drug Administration: Intrathecal (Oncology) - CE

recommendations for practice (pp. 193-227). Pittsburgh: Oncology Nursing Society. (Level VII)

15. Sviggum, H.P. and others. (2012). Neurologic complications after chlorhexidine antisepsis for spinal anesthesia. Regional Anesthesia and Pain Medicine, 37(2), 139-144. doi:10.1097/AAP.0b013e318244179a (classic reference)* (Level II)


*In these skills, a “classic” reference is a widely cited, standard work of established excellence that significantly affects current practice and may also represent the foundational research for practice.

Elsevier Skills Levels of Evidence

- Level I - Systematic review of all relevant randomized controlled trials
- Level II - At least one well-designed randomized controlled trial
- Level III - Well-designed controlled trials without randomization
- Level IV - Well-designed case-controlled or cohort studies
- Level V - Descriptive or qualitative studies
- Level VI - Single descriptive or qualitative study
- Level VII - Authority opinion or expert committee reports

Supplies

- 22-G atraumatic needle for LP
- 25-G or smaller needle for Ommaya reservoir access
- Antiseptic solution (e.g., povidone iodine, chlorhexidine-based)
- PPE
  - For isolation precautions: gloves and PPE, as indicated
  - For antineoplastic administration: sterile gloves tested and approved for use with antineoplastic drugs, impervious solid-front long-sleeve chemotherapy-resistant gown, mask, face shield or eye protection
- CSF collection tubes
- Plastic-backed absorbent pad
- Preservative-free anesthetic solution (e.g., 1% lidocaine)
- Preservative-free drug
- Preservative-free 0.9% sodium chloride solution
- Sterile towel or barrier
- Sterile gauze pads
- Sterile LP tray if indicated
- Syringes

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