



A Comprehensive Nursing Care Approach for a Child with Osteosarcoma and Pulmonary Metastasis: A Case Study

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Abstract

Background: Osteosarcoma is a serious pediatric malignancy that may result in substantial physical, psychological, developmental, and social consequences. Children with advanced disease may require multimodal treatment while experiencing pain, impaired mobility, treatment-related adverse effects, and disruption of education and social participation.

Case Presentation: This case study described an 8-year-old Thai girl with osteosarcoma of the left distal femur with pulmonary metastasis. She had previously undergone wide excision with proximal tibial reconstruction and was admitted for her 13th chemotherapy treatment. During hospitalization, imaging demonstrated progression of multiple calcified pulmonary nodules and metastatic involvement of the thoracic spine, followed by T6–T8 laminectomy.

Methods: A descriptive single-case study was conducted using a predefined episode of care from August 2021 to November 2022. Data were obtained through triangulation of the clinical record, nursing documentation, laboratory and imaging results, treatment records, direct nursing observation, and caregiver-reported information. Data were organized chronologically and interpreted descriptively across physical, functional, developmental, psychosocial, and family-care domains.

Nursing Management and Outcomes: Nursing care focused on chemotherapy safety, infection prevention, postoperative care, pain management, nutrition, mobility, developmental needs, psychosocial support, and family participation. The child completed chemotherapy, and pain improved with multimodal management. The caregiver actively participated in care, and the mother's stress score decreased from 4 to 3.

Conclusion: Comprehensive, family-centered nursing care addressed the child's physical, developmental, psychosocial, and family needs beyond chemotherapy treatment.

Keywords: osteosarcoma; pulmonary metastasis; pediatric nursing; comprehensive nursing care; family-centered care

1. Introduction

Osteosarcoma is a malignant bone tumor that can have profound effects on children because the disease and its treatment may interfere with physical function, mobility, growth, education, psychological well-being, and family life. (Strauss, S. J., Frezza, A. M., Abecassis, N., Bajpai, J., Bauer, S.,

Biagini, R., et al., 2021)., Eaton, B. R., Schwarz, R., Vatner, R., Yeh, B., Claude, L., Indelicato, D. J., et al., 2021; National Cancer Institute, 2025). In children with metastatic disease, particularly pulmonary or skeletal metastases, clinical management can become substantially more complex because treatment-related complications occur alongside progressive functional impairment. (Strauss, S. J., Frezza, A. M., Abecassis, N., Bajpai, J., Bauer, S., Biagini, R., et al., 2021; Pastorino, U., Palmerini, E., Porcu, L., Luksch, R., Scanagatta, P., Meazza, C., et al., 2023).

Pediatric oncology nursing requires more than the administration and monitoring of antineoplastic therapy. Nurses need to assess treatment tolerance, laboratory findings, infection risk, pain, nutritional status, functional ability, developmental needs, emotional responses, and caregiver capacity. (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Siegel, R. D., LeFebvre, K. B., Temin, S., Evers, A., Barbarotta, L., Bowman, R. M., et al., 2024). In children, these dimensions are closely interconnected. Prolonged hospitalization and repeated treatment may restrict participation in school and peer activities, potentially affecting developmental tasks and social relationships.

Family participation is an important component of pediatric nursing care. Parents or primary caregivers frequently provide assistance with activities of daily living, medication management, nutrition, hygiene, symptom monitoring, and emotional support. For children receiving long-term cancer treatment, nursing care should therefore incorporate the caregiver as a partner in the care process (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Kanchanoudom, P., & Siripool).

This case was selected because it represented a clinically complex episode of osteosarcoma of the left distal femur with pulmonary and subsequent vertebral metastases, previous limb-sparing surgery, significant mobility limitations, and repeated chemotherapy. The prolonged illness also affected the child's schooling and peer interactions.

This case study aimed to describe a comprehensive nursing care approach addressing clinical assessment, chemotherapy, pain and functional management, developmental and psychosocial needs, family participation, and continuity of care, providing practical insights for pediatric oncology nursing in complex metastatic disease.

2. Case Study Methodology

2.1 Study Objective, Design, and Case Selection

A descriptive single-case study design was used. The case was purposively selected because it represented a complex pediatric oncology episode that combined primary osteosarcoma, pulmonary metastasis, later vertebral metastasis, repeated chemotherapy, major mobility impairment, spinal surgery, infection risk, developmental disruption, and substantial caregiver involvement. This combination allowed the nursing process to be described across multiple interconnected domains rather than focusing only on chemotherapy administration.



2.2 Case Boundaries

The case boundary extended from the child's initial presentation with left-knee pain and swelling in August 2021 through the reported hospitalization for the 13th chemotherapy course in October 2022 and follow-up documentation through November 3, 2022. The principal clinical setting was the pediatric chemotherapy unit, with the case episode also including diagnostic imaging, orthopedic consultation, T6–T8 laminectomy, postoperative care, and follow-up nursing assessment.

2.3 Data Sources and Data Collection

Case information was collected retrospectively from multiple clinical sources to strengthen the completeness of the case description. Sources included the medical record; nursing assessment and progress notes; medication and treatment records; complete blood count and biochemical results; urinalysis; radiological and MRI findings; operative and postoperative documentation; direct nursing observations during the care episode; and information reported by the child's mother during routine nursing assessment and follow-up. No separate research interview or questionnaire was administered. The authors organized the information according to the clinical timeline and the domains of comprehensive pediatric nursing assessment.

2.4 Data Analysis

The collected information was analyzed descriptively. Clinical events, assessments, nursing interventions, and outcomes were first arranged chronologically and then synthesized across the major nursing domains: treatment safety, infection, postoperative status, pain, mobility, nutrition, development and education, psychosocial well-being, caregiver participation, and continuity of care. The identified nursing priorities and care processes were then interpreted in relation to pediatric oncology nursing principles and relevant literature. This approach was consistent with the descriptive and explanatory purpose of a case study and did not involve inferential statistical testing. Gagnier, J. J., Kienle, G., Altman, D. G., Moher, D., Sox, H., Riley, D., & CARE Group., 2013; Riley, D. S., Barber, M. S., Kienle, G. S., Aronson, J. K., von Schoen-Angerer, T., Tugwell, P., et al., 2017).

3. Case Presentation

3.1 Patient Characteristics

The patient was an 8-year-old Thai girl admitted to a pediatric chemotherapy unit on October 18, 2022, for scheduled chemotherapy. She had a known diagnosis of osteosarcoma of the left distal femur with pulmonary metastasis and was receiving her 13th course of chemotherapy.

Her medical history indicated that she initially developed pain and swelling with redness around the left knee in August 2021, at approximately 7 years of age. She was subsequently evaluated at Khon Kaen Hospital and diagnosed with osteosarcoma. In February 2022, she underwent wide excision with proximal tibial reconstruction and rotational reconstruction.

At the current admission, the principal diagnosis was documented as osteosarcoma of the left distal femur with pulmonary metastasis. The record also described lower-extremity weakness and a deformity of the left leg.

Table 1. Clinical Timeline

Date/Period	Clinical events and findings	Diagnostic/therapeutic interventions	Nursing relevance/outcomes
August 2021	Developed pain, swelling, and redness around the left knee; diagnosed with osteosarcoma of the left distal femur.	Diagnostic evaluation and initial assessment.	Focused on pain, mobility, and functional limitation.
February 28, 2022	Underwent definitive surgery for the primary tumor.	Wide excision with proximal tibial and rotational reconstruction.	Monitored mobility, limb function, pain, wound, and ADLs.
October 18, 2022	Admitted for the 13th chemotherapy treatment; osteosarcoma with pulmonary metastasis.	Pre-chemotherapy CBC, renal/electrolyte tests, and urinalysis; ANC 2,069.1 cells/ μ L.	Prioritized chemotherapy safety, infection surveillance, hydration, and nutrition.
October 18–24, 2022	Received chemotherapy.	Ifosfamide 2,400 mg IV $\times$ 5 days with mesna and ondansetron.	Monitored vital signs, nausea/vomiting, intake, urine, laboratory results, and adverse effects.
October 24, 2022	Completed prescribed chemotherapy.	Supportive treatment continued.	No hematuria; urine remained clear/yellow.
October 25, 2022	Severe lower-extremity functional impairment; pulmonary nodules showed slight progression.	CT chest and continued disease surveillance.	Monitored disease progression and functional status.
October 26, 2022	Spinal metastatic disease with neurological and mobility concerns.	T6–T8 laminectomy; T6–T7 spinal metastases identified intraoperatively.	Monitored neurological/respiratory status, wound, fluid balance, and pain.
October 26–27, 2022	Postoperative period with pain, fever, and leukopenia.	Morphine PCA, IV fluids, antibiotics, and laboratory monitoring.	Prioritized pain control, postoperative monitoring, and infection prevention.
October 30, 2022	Severe neutropenia: WBC 0.8 $\times$ 10 ³ / μ L; ANC 244 cells/ μ L.	Continued CBC surveillance and infection management.	High infection risk required intensive protective nursing care.
During hospitalization	Severe mobility limitation, social isolation, and interrupted schooling.	Wheelchair/bed-based activities, ROM, positioning, pressure-area care, and educational activities.	Addressed physical, developmental, educational, and psychosocial needs.
During hospitalization	Mother was the primary caregiver and actively participated in care.	Education on disease management, medications,	Supported family-centered care and readiness for home care.



Date/Period	Clinical events and findings	Diagnostic/therapeutic interventions	Nursing relevance/outcomes
		warning signs, nutrition, hygiene, and follow-up.	
Date/Period	Clinical events and findings	Diagnostic/therapeutic interventions	Nursing relevance/outcomes
August 2021	The child developed pain, swelling, and redness around the left knee.	Diagnostic evaluation led to the diagnosis of osteosarcoma of the left distal femur.	Initial assessment focused on pain, mobility, and functional limitation.

3.2 Chemotherapy Treatment

The child was admitted for scheduled chemotherapy with ifosfamide 2,400 mg intravenously for 5 days. Mesna 600 mg intravenously was administered during the chemotherapy course for uroprotection, and ondansetron was prescribed as premedication and subsequently for nausea and vomiting.

Before chemotherapy, complete blood count and biochemical investigations were performed. The initial absolute neutrophil count (ANC) was 2,069.1, which was considered adequate for chemotherapy according to the treatment record. The treatment plan also included monitoring of creatinine, electrolytes, calcium, magnesium, and urinalysis. (Phanthangkul, W., & Siriruang, S., 2007; Sanpakit, K., n.d.); Thai Pediatric Oncology Group, Thai Society of Hematology, & National Health Security Office, 2014). The child completed the prescribed chemotherapy on October 24, 2022.

3.3 Disease Progression and Metastatic Involvement

During the hospitalization, imaging demonstrated progression of multiple calcified nodules in both lungs. A subsequent MRI identified bone metastasis at the T7 vertebra. Because of spinal metastatic involvement and associated neurological and functional concerns, an orthopedic consultation was obtained.

On October 26, 2022, the child underwent T6–T8 laminectomy for spinal metastatic disease involving T6–T7. Postoperatively, she received patient-controlled analgesia, intravenous fluids, and antimicrobial therapy.

3.4 Initial Clinical Assessment

On October 25, the child was conscious, responsive, and maintained eye contact. Vital signs were temperature 36.3°C, pulse 74 beats/minute, and blood pressure 105/58 mmHg; weight was 40 kg and height 133 cm. Mild dry lips and alopecia were noted. Significant functional impairment was present, with muscle strength of grade 4 in the right upper extremity, grade 1 in the left upper extremity, and profound bilateral lower-extremity weakness with left-leg deformity. She was unable to ambulate independently and required assistance, a wheelchair, or a walker.

On October 27, following spinal surgery, vital signs were temperature 37.4°C, pulse 108 beats/minute, respiratory rate 20 breaths/minute, and blood pressure 104/61 mmHg.

4. Comprehensive Nursing Assessment

A comprehensive assessment was performed using the principles of holistic pediatric nursing and Gordon's functional health patterns. Only clinically relevant findings are presented below. (Herdman, T. H., Kamitsuru, S., & Lopes, C. T. (Eds.), 2024; Potter, P. A., Perry, A. G., Stockert, P. A., & Hall, A. M., 2021; Alfaro-LeFevre, R., 2023)

4.1 Health Perception and Health Management

The mother was actively involved in the child's care and demonstrated knowledge of the child's illness and treatment schedule. The child had received multiple courses of chemotherapy and regularly attended scheduled medical appointments. The mother assisted with bathing, dressing, eating, oral hygiene, and other activities of daily living. She also monitored the child's temperature and symptoms at home and sought medical attention when symptoms worsened.

4.2 Nutritional and Metabolic Status

The child consumed three meals daily but reportedly preferred milk and snacks during illness. Following chemotherapy, she experienced nausea, vomiting, decreased appetite, and reduced food intake. These symptoms improved after completion of chemotherapy.

At assessment, her weight was 40 kg and height was 133 cm. The case record classified her as having weight above the expected range for age and described limited physical activity. Mild dryness of the lips was noted, but there was no peripheral edema. The oral mucosa was intact without ulcers.

4.3 Elimination

Urination was reported to occur approximately 7–8 times per day during illness. The urine was described as clear and yellow, with no dysuria or hematuria. Urinalysis was negative for blood, protein, glucose, ketones, nitrite, and leukocytes. Bowel movements were variable, and constipation occurred during periods of reduced mobility and opioid treatment. Milk of Magnesia and later lactulose were prescribed.

4.4 Activity and Mobility

Mobility was one of the most significant clinical concerns. The child was unable to walk independently and required a wheelchair or walker. She remained primarily in bed during hospitalization.

The left leg was deformed, and lower-extremity muscle strength was markedly reduced. The child required assistance with positioning and activities of daily living. The prolonged immobility placed her at risk for pressure injury, constipation, further muscle weakness, and loss of functional independence.

4.5 Sleep and Rest

The child generally slept approximately 7–8 hours at night and took a daytime nap. She was usually observed to have a relatively fresh appearance without marked sleep disturbance.

4.6 Cognitive and Developmental Status

Before illness, the child's developmental screening had reportedly been appropriate for age. She was in Grade 2. During prolonged illness, however, she was unable to attend school regularly and



subsequently repeated Grade 2. The mother provided home teaching, and a hospital teacher also participated in her education.

The child was able to communicate, read and write in Thai to some extent, and perform simple arithmetic. She demonstrated difficulty with more advanced mathematical tasks and English sentence reading.

4.7 Pain and Perceptual Status

Pain was associated primarily with movement and repositioning. The child reported pain when moving or being turned but did not report pain while remaining still. At one point, pain was rated 6/10.

After spinal surgery, postoperative back pain was managed with PCA and opioid analgesics. By October 27, the mother reported improvement, with the pain score decreasing from 8 to 6 and the child requiring PCA on two occasions.

4.8 Psychosocial and Family Assessment

The child lived in a supportive family environment. Her mother was the primary caregiver and decision maker.

Before illness, the child regularly attended school and interacted with peers. Following diagnosis and prolonged treatment, she became socially isolated and spent more time at home or in hospital.

The child sometimes became fearful and cried during procedures, calling for her mother. Nevertheless, she generally cooperated with treatment.

The mother initially experienced anxiety related to the child's chronic illness, prognosis, treatment, and financial concerns. An ST5 stress assessment initially yielded a score of 4, interpreted in the case record as mild stress at subsequent assessment.

4.9 Spiritual and Cultural Considerations

The family reported Buddhist beliefs and expressed confidence in modern medical treatment. The mother also used prayer and spiritual practices as a source of emotional support. A religious object was placed near the child's bedside as a symbolic source of protection and hope.

These beliefs were incorporated respectfully into the family-centered approach without interfering with medical treatment.

5. Priority Nursing Diagnoses

Based on the assessment, the following nursing problems were prioritized:

1. Risk for postoperative complications related to surgical intervention and anesthesia.
2. Risk for infection related to malignancy, chemotherapy, invasive procedures, and reduced immune defense.
3. Risk for complications associated with prolonged immobility, including pressure injury, constipation, and muscle weakness.

4. Chronic pain-related discomfort associated with metastatic disease, surgical intervention, and movement.
5. Caregiver anxiety related to the child's chronic and complex illness.
6. Risk for impaired developmental progression related to prolonged illness, hospitalization, and interruption of schooling.
7. Impaired social interaction related to prolonged separation from school and peers.
8. Risk for ineffective home management related to the complexity and changing course of the child's disease.

6. Nursing Interventions

6.1 Chemotherapy Safety and Monitoring

In this case, chemotherapy safety was particularly important because the child was receiving her 13th treatment course and had an initial ANC of 2,069.1 cells/ μ L. Nursing care therefore focused on confirming treatment readiness and monitoring for ifosfamide-related complications.

Nursing care began with verification of the chemotherapy treatment plan and assessment of laboratory readiness. CBC, renal function, serum electrolytes, and urinalysis were monitored as ordered.

The initial ANC was 2,069.1. The child received ifosfamide 2,400 mg intravenously for 5 days, together with mesna and ondansetron.

The nursing team monitored: vital signs; level of consciousness; nausea and vomiting; oral intake; urine output and urine characteristics; signs of hematuria; laboratory findings; hydration status; and treatment-related adverse effects. The child completed the chemotherapy course on October 24.

6.2 Prevention and Management of Infection

In this case, infection surveillance became more intensive after spinal surgery because fever, leukopenia, and severe neutropenia subsequently developed. The ANC fell to 244 cells/ μ L and WBC to $0.8 \times 10^3/\mu$ L on October 30. Because of chemotherapy and subsequent surgical intervention, infection surveillance was emphasized. Nursing interventions included: monitoring temperature and vital signs; monitoring CBC and ANC; assessing for respiratory symptoms; assessing surgical and invasive sites; maintaining appropriate hygiene; reinforcing hand hygiene; maintaining a clean environment; monitoring oral and skin integrity; and administering antimicrobial therapy according to the medical treatment plan.

Following the spinal procedure, the child developed fever with a low WBC count. On October 30, the ANC was 244 and WBC was 0.8. The treatment record documented administration of cefazolin, ceftazidime (Fortum), and amikacin. This period demonstrated the importance of continued infection surveillance even after completion of chemotherapy.

6.3 Postoperative Monitoring

In this case, postoperative nursing care followed T6–T8 laminectomy for metastatic spinal disease. The priority was early recognition of neurological, respiratory, bleeding, wound, fluid-balance, and



pain-related complications. Following T6–T8 laminectomy, nursing care focused on: neurological assessment; level of consciousness; respiratory status; wound assessment; bleeding surveillance; drain monitoring; pain assessment; fluid balance; vital-sign monitoring; and observation for postoperative complications. The child received intravenous fluid therapy and antibiotic treatment as prescribed. Her postoperative respiratory status remained stable, with an oxygen saturation of 97% documented on October 26.

6.4 Pain Management

In this case, pain was associated with movement, repositioning, metastatic disease, and postoperative back pain. The documented pain score decreased from 8/10 to 6/10, and PCA was required only twice on the reported assessment day. Pain was assessed using a numeric pain rating scale and through observation of facial expression and behavior. The child experienced pain primarily during movement and repositioning. Nursing interventions included: regular pain assessment; appropriate positioning; supporting the affected extremity; minimizing unnecessary painful movement; providing distraction through storytelling, drawing, and coloring; encouraging age-appropriate activities when tolerated; administering prescribed analgesics; and monitoring response to opioid analgesics and PCA.

Postoperatively, the child received PCA containing morphine. Additional medications included paracetamol and oral morphine as required. By October 27, the mother reported that the child's pain had improved. PCA was used only twice, and the record described pain as controlled.

6.5 Prevention of Complications from Immobility

In this case, severe lower-extremity weakness, left-leg deformity, wheelchair/bed dependence, and limited ambulation created a high risk for pressure injury, constipation, further muscle weakness, and loss of independence. Because the child was unable to ambulate independently, preventive care was essential. Nursing interventions included: assessing muscle strength and functional mobility; inspecting pressure points; repositioning the child regularly; using pillows or pressure-relieving supports; maintaining clean and dry skin; encouraging appropriate range-of-motion exercises; encouraging activity within prescribed limitations; supporting physiotherapy activities; monitoring bowel function; encouraging adequate fluid intake; and administering prescribed laxatives when necessary. The child remained largely bed-bound but was able to perform selected activities, such as brushing her teeth, with assistance. The caregiver was taught how to assist with positioning, exercises, hygiene, and observation of pressure areas.

6.6 Nutritional Support

In this case, nausea, vomiting, and decreased appetite occurred after chemotherapy. Nursing care therefore emphasized tolerable food intake, hydration, oral integrity, protein intake, and food safety while involving the mother in meal preparation. The nursing team assessed dietary intake and treatment-related symptoms. The child experienced nausea, vomiting, and reduced appetite following chemotherapy. Interventions included: monitoring food and fluid intake; encouraging small, tolerable meals; promoting adequate protein intake; reinforcing food hygiene; encouraging adequate hydration; monitoring oral mucosal

integrity; and supporting the caregiver in preparing acceptable foods. The child reportedly resumed more normal eating after completion of chemotherapy.

6.7 Developmental and Educational Support

In this case, prolonged illness had interrupted regular schooling and the child had repeated Grade 2. Developmental nursing care therefore included home- and hospital-based learning and age-appropriate activities. Developmental care was incorporated into the nursing plan because prolonged illness had interrupted normal schooling. The child was encouraged to participate in age-appropriate activities such as: drawing; coloring; storytelling; reading; simple mathematics; English vocabulary practice; and structured play.

The mother and hospital teacher were encouraged to participate in maintaining educational continuity. This approach was intended to reduce the developmental consequences of prolonged hospitalization and help preserve the child's sense of competence and achievement.

6.8 Psychosocial and Family-Centered Care

In this case, the mother was the primary caregiver and the child sometimes became fearful and cried during procedures. Nursing care therefore emphasized developmentally appropriate communication, maternal participation, emotional support, and confidence in home care. The nursing approach emphasized communication with both the child and mother. Interventions included: establishing a trusting relationship; allowing the mother to express concerns; explaining procedures in developmentally appropriate language; encouraging the child's participation in care; providing emotional reassurance; using play and distraction during procedures; supporting family participation; recognizing caregiver fatigue; and reinforcing the caregiver's confidence in managing the child's care. The mother's initial anxiety was addressed through information, supportive communication, and opportunities to discuss concerns.

6.9 Discharge and Continuing-Care Education

In this case, discharge preparation needed to address the changing clinical course, impaired mobility, infection risk, ongoing cancer treatment, and the mother's role in monitoring symptoms at home. Discharge education incorporated the D-METHOD framework used in the original nursing care plan.

Key areas included: **Disease:** Understanding osteosarcoma, metastatic disease, and the importance of ongoing treatment. **Medication:** Understanding prescribed medications and their administration. **Environment:** Maintaining a clean, safe, and accessible home environment, particularly because of impaired mobility and infection risk. **Treatment:** Understanding chemotherapy and other ongoing medical treatments. **Health:** Maintaining adequate rest, hygiene, oral care, nutrition, hydration, and infection prevention. **Outpatient follow-up:** Attending scheduled medical appointments and seeking medical attention when warning signs occur. **Diet:** Providing adequate nutrients and emphasizing food safety, including properly cooked food and avoidance of potentially contaminated foods.

The caregiver was also instructed to observe for fever, chills, respiratory symptoms, oral or skin lesions, dizziness, and other changes that could indicate complications.



7. Outcomes The nursing outcomes were evaluated throughout the hospitalization and follow-up period.

7.1 Chemotherapy Outcome

The child completed the prescribed 5-day ifosfamide chemotherapy regimen with mesna and antiemetic support.

No hematuria was documented during the chemotherapy period, and urine was described as clear and yellow.

7.2 Infection-Related Outcome

Although the child subsequently developed fever and significant leukopenia/neutropenia, the condition was identified through ongoing monitoring and treated according to the medical plan.

On October 30, WBC was 0.8 and ANC was 244. This finding demonstrates that continued surveillance remained necessary even after completion of chemotherapy.

7.3 Pain Outcome

Pain improved following surgery and analgesic management. The mother reported a reduction in pain from a score of 8 to 6, and the child required PCA only twice on the reported assessment day. Later documentation described pain as controlled and PCA was discontinued.

7.4 Mobility and Functional Outcome

The child continued to have substantial functional limitations and was unable to ambulate independently. However, she participated in selected activities of daily living and therapeutic exercises with caregiver assistance.

No established pressure injury was documented; a non-red pressure area was observed over the sacral region and managed through preventive nursing care.

7.5 Nutritional Outcome

The child experienced temporary nausea, vomiting, and reduced appetite following chemotherapy. Her appetite subsequently improved after completion of chemotherapy.

7.6 Developmental Outcome

Although normal school attendance remained interrupted, the child participated in home- and hospital-based learning activities. She demonstrated the ability to read and write in Thai and perform simple arithmetic and participated in developmentally appropriate activities.

7.7 Caregiver Outcome

The mother remained actively involved in care and demonstrated knowledge of hygiene, nutrition, symptom monitoring, mobility support, and follow-up.

The mother's ST5 score was documented as 4 on November 1 and November 2 and decreased to 3 on November 3. The record subsequently documented that she reported no continuing anxiety regarding chemotherapy adverse effects.

Table 2. Priority Nursing Problems, Interventions, and Outcomes

Priority nursing problem	Assessment findings	Major nursing interventions	Outcomes/ evaluation
1. Risk for postoperative complications related to spinal surgery and anesthesia	Underwent T6–T8 laminectomy for spinal metastasis; postoperative PCA and IV fluids were required.	Monitored level of consciousness, neurological status, vital signs, respiratory status, surgical wound, bleeding, drainage, fluid balance, and pain; maintained prescribed postoperative treatment.	Postoperative monitoring was continued; the child was documented as conscious after surgery and received pain management.
2. Risk for infection related to malignancy, chemotherapy, invasive procedures, and reduced immune defense	Fever developed; WBC $0.8 \times 10^3/\mu\text{L}$ and ANC 244 cells/ μL on October 30.	Monitored temperature, vital signs, CBC/ANC, respiratory symptoms, wound and invasive sites; promoted hygiene and oral/skin care; administered prescribed antimicrobials; educated caregiver regarding infection warning signs.	Severe neutropenia was identified promptly and managed with continued surveillance and antimicrobial therapy.
3. Risk for complications from prolonged immobility	Severe lower-extremity weakness; inability to ambulate independently; left leg deformity; prolonged bed/wheelchair dependence.	Repositioning; pressure-area assessment; use of pillows/pressure-relieving measures; skin hygiene; ROM exercises; activity as tolerated; physiotherapy; bowel monitoring; hydration and prescribed laxatives.	No established pressure injury was documented; preventive measures were maintained. Mobility remained markedly impaired because of the underlying disease and neurological involvement.
4. Chronic/acute pain related to metastatic disease, surgery, and movement	Pain occurred with movement/repositioning; postoperative back pain required PCA; pain was reported to decrease from 8/10 to 6/10 in the documented assessment.	Regular pain assessment; positioning; support of affected areas; minimizing painful movement; distraction through stories, drawing, and coloring; prescribed analgesics and PCA.	Pain was reduced with multimodal management; PCA was used and subsequently discontinued when clinically appropriate.



Priority nursing problem	Assessment findings	Major nursing interventions	Outcomes/ evaluation
5. Risk for inadequate nutrition/hydration related to chemotherapy	Mildly dry lips; nausea/vomiting and decreased intake were reported around chemotherapy; appetite improved afterward.	Monitored intake, nausea/vomiting, oral mucosa, hydration, and weight; encouraged small frequent meals and adequate protein/fluid intake; reinforced food hygiene.	Oral intake and appetite improved following chemotherapy; hydration and nutritional status continued to be monitored.
6. Risk for impaired developmental progression related to prolonged illness and hospitalization	School attendance was interrupted; the child repeated Grade 2; mother and hospital teacher supported learning.	Provided age-appropriate reading, writing, mathematics, English, drawing, coloring, play, and structured learning activities; encouraged caregiver participation.	The child continued educational and developmental activities despite interruption of regular schooling.
7. Impaired social interaction related to separation from school and peers	Unable to attend school regularly and separated from friends; preferred using a mobile phone; communication remained possible during interaction.	Encouraged communication, therapeutic play, age-appropriate activities, emotional expression, and family interaction.	The child participated in selected activities and maintained interaction with caregivers and healthcare providers.
8. Caregiver anxiety/stress related to prolonged and complex illness	Mother was the primary caregiver and initially expressed concern regarding chemotherapy adverse effects; ST-5 score was documented as 4 and later 3.	Provided clear explanations, opportunities for questions, emotional support, involvement in care, and education about treatment, adverse effects, warning signs, nutrition, hygiene, and follow-up.	The documented caregiver stress score decreased from 4 to 3, and the mother subsequently reported no anxiety regarding chemotherapy adverse effects.
9. Risk for ineffective home management related to	Complex treatment course involving chemotherapy, surgery, metastatic disease,	Provided discharge education using the D-METHOD framework, including disease, medication, environment,	Caregiver received education and participated actively in the child's care,

Priority nursing problem	Assessment findings	Major nursing interventions	Outcomes/ evaluation
complex and changing disease status	mobility limitations, and changing clinical status.	treatment, health promotion, outpatient follow-up, diet, and warning signs.	supporting continuity of care after discharge.

8. Discussion

This case demonstrated the complexity of caring for a child with osteosarcoma and metastatic disease. Nursing challenges extended beyond cancer treatment to include chemotherapy-related risks, neurological and functional impairment, pain, developmental disruption, social isolation, and caregiver stress.

8.1 Comprehensive Assessment in Pediatric Oncology Nursing

Comprehensive assessment identified not only physical limitations but also effects on education, peer relationships, family functioning, and emotional well-being (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Siegel, R. D., LeFebvre, K. B., Temin, S., Evers, A., Barbarotta, L., Bowman, R. M., et al., 2024; Kanchanoudom, P., & Siripool, P., 2023). A structured assessment framework helped identify needs that might otherwise have been overlooked during chemotherapy.

8.2 Chemotherapy Safety as a Nursing Priority

Nursing care during ifosfamide-based chemotherapy included laboratory monitoring, hydration, urine assessment, and surveillance for adverse effects (Strauss, S. J., Frezza, A. M., Abecassis, N., Bajpai, J., Bauer, S., Biagini, R., et al., 2021; Siegel, R. D., LeFebvre, K. B., Temin, S., Evers, A., Barbarotta, L., Bowman, R. M., et al., 2024). The decrease in ANC from 2,069.1 to 244 cells/ μ L highlighted the importance of continuous laboratory and infection-risk monitoring throughout treatment.

8.3 Pain and Functional Impairment

Pain was associated with movement, surgery, and metastatic disease. Pharmacological and non-pharmacological strategies, including positioning, supported movement, and distraction, were integrated into care (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Dupuis, L. L., et al., 2019). Integrating pain management with mobility support was important for maintaining activity and participation in daily and developmental activities.

8.4 Developmental Consequences of Chronic Illness

Prolonged illness interrupted schooling and contributed to the child repeating Grade 2 (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Kanchanoudom, P., & Siripool, P., 2023). Pediatric oncology nursing should therefore include developmental preservation through educational activities, play, communication, and opportunities for age-appropriate achievement.



8.5 Social Isolation and Family-Centered Care

Reduced peer contact increased the child's dependence on family, with the mother serving as the primary source of physical and emotional support. She actively participated in hygiene, nutrition, mobility, developmental activities, and symptom monitoring (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Kanchanoudom, P., & Siripool, P., 2023). The reduction in caregiver stress during follow-up suggested improved confidence in managing the child's care.

8.6 Implications for Pediatric Nursing Practice

This case supported a multidimensional approach integrating treatment safety, physical health, functional ability, developmental needs, and family well-being (Robinson, P. D., Tomlinson, D., Beauchemin, M., Gibson, P., Grimes, A., Dadzie, G., et al., 2021; Siegel, R. D., LeFebvre, K. B., Temin, S., Evers, A., Barbarotta, L., Bowman, R. M., et al., 2024; Kanchanoudom, P., & Siripool, P., 2023). For children with advanced osteosarcoma, nursing care should systematically address mobility, pain, infection risk, nutrition, psychological responses, schooling, social interaction, caregiver stress, and home-care capacity.

9. Implications for Clinical Practice

Based on this case, the following recommendations may support pediatric oncology nursing practice:

9.1 Use comprehensive assessment to address physical, developmental, psychological, social, and family needs.

9.2 Monitor treatment-related complications continuously, particularly CBC/ANC, hydration, urinary findings, and adverse symptoms.

9.3 Integrate pain management with functional rehabilitation to support mobility and daily activities.

9.4 Provide developmental and educational support during prolonged hospitalization or interrupted schooling.

9.5 Engage parents as care partners through education, symptom monitoring, emotional support, and preparation for home care and changing treatment needs.

10. Strengths and Limitations of the Case

The main strength of this case is its demonstration of comprehensive nursing care addressing chemotherapy, laboratory monitoring, pain, mobility, developmental needs, caregiver participation, and discharge preparation.

However, this single-patient case limits generalizability. Some clinical information and terminology were incomplete or inconsistent and should be verified against the original medical record. Long-term outcomes after discharge were also not systematically documented.

11. Conclusion

This case demonstrated that comprehensive nursing care for a child with osteosarcoma and pulmonary metastasis should address treatment safety, physical function, pain, infection risk, nutrition, development, psychosocial well-being, and family participation. Key outcomes included completion of chemotherapy, management of severe neutropenia and postoperative pain, ongoing functional limitations, maintenance of developmental activities, and active caregiver participation.

The case supports a holistic, family-centered approach in pediatric oncology nursing, integrating treatment, functional, developmental, psychosocial, and family needs. Structured assessment, laboratory monitoring, pain and mobility management, developmental support, caregiver involvement, and discharge education may support care for children with complex metastatic disease. Future studies should use standardized outcomes, longitudinal follow-up, and patient- and family-reported measures.

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