CHAPTER - 7

INNOVATIONS IN PEDIATRIC ONCOLOGY NURSING – TREATMENT AND SUPPORTIVE CARE

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Abstract

Paediatric oncology nursing has evolved signicantly, integrating ground breaking advancements in treatment and supportive care to enhance outcomes for young cancer patients. Innovations such as precisine medicine, targeted therapy, and immunotherapy have revolutionised cancer treatment, minimising side effects and improving survival rate. Additionally new pain management technique, including virtual reality, guided imaginary, and music therapy, provide holistic comfort and emotional relief. Technology, such as wearable health monitors and telehealth services, allows for more personalised and accessible care. Family cantered approaches ensure that both patients and caregivers receive the necessary support, reducing anxiety and improving treatment adherence. Furthermore, survivorship programs play a crucial role in long term health advancements, combined with the compassion and dedication of paediatric oncology nurses, continue to transform the landscape of childhood cancer care, offering hope and improved quality of life for affected children and their families.

Keywords: Paediatric oncology, nursing innovations, precision medicine, targeted therapy, immunotherapy, symptom management, holistic care.

Objectives

This chapter aims to

- Highlights research advancements in paediatric oncology nursing that enhance treatment effectiveness and patient comfort.
- Explore innovative pain and symptom management techniques that improve the quality of life for children undergoing cancer treatment.
- Examine the role of family cantered and holistic care in supporting both patients and their families.
- Discuss the impact of technology in modern paediatric oncology care, making treatment more accessible and efficient.

7.1 Introduction

Paediatric oncology nursing is a field that has seen remarkable progress over the years. Childhood cancer presents unique challenges, not only due to the complexity of the disease but also because of children's patients require specialised care to provide their physical emotional needs. Nurses plays a crucial role in providing holistic care that extends beyond medical treatment, addressing the psychological and social aspects of the patient's journey. Over the years, advancements in medicine, technology, and nursing practices have significantly improved survival rates and the quality of life for paediatric patient care. With ongoing research breakthroughs, paediatric oncology nursing has embraced innovative approaches that focus on precision medicine, pain management, and family cantered care. The integration of digital health tools, telemedicine, and survivorship program has further enhanced the ability to monitor and support young patients beyond the hospital setting. This chapter explore some of the most exiting exciting innovations in paediatric cancer care and how they are making a profound difference in the lives of children and their families. Paediatric oncology nursing is a field that has seen remarkable progress over the years. Children

diagnosed with cancer face immense physical, emotional, and psychological challenges and nurses play crucial role in providing care for the patients with cancer. Paediatric nurses are now better equipped to provide treatment that are not only effective but also less distressing for children's and their families. This chapter explores some of the most exciting innovations in paediatric cancer care and how they are making a difference in real lives.

7.2 Personalized Treatment with Precision Medicine

In the past, cancer treatments were often one-size-fits-all, leading to severe side effects for many children. Now, with precision medicine, treatments are tailored to each child's unique genetic profile. Targeted therapies, such as immunotherapy and monoclonal antibodies, attack cancer cells while leaving healthy cells untouched, reducing harmful side effects.





Dimensions of synergy between AI and precision medicine. Both precision medicine and artificial intelligence (AI) techniques impact the goal of personalizing care in five ways: therapy planning using clinical, genomic or social and behavioural determinants of health, and risk prediction/diagnosis, using genomic or other variables.

7.3 Pain and Symptom Relief Innovations Peripheral Nerve Blocks

Peripheral nerve blocks have been used in the treatment of various pediatric cancer pain conditions. While systemic analgesia is often used first in this population, it can be rendered ineffective or severely limited by adverse effects, including nausea, vomiting, pruritis, and sedation, which can be profound. Peripheral nerve blockade involves the delivery of local anaesthetic medications, occasionally with adjuvants, such as alpha-2 agonists or corticosteroids, in proximity to a peripheral nerve to produce a targeted sensory block. This technique can be employed as a single injection, as repeated injections via a catheter, or as a continuous infusion. A retrospective study involving 108 pediatric (age 2–18) patients undergoing orthopaedic tumor surgery demonstrated the effectiveness of peripheral nerve blockade in this population.

7.3.1 Sympathetic Blocks

Sympathetic blockade, commonly used to treat painful conditions, such as complex regional pain syndrome types 1 and 2, herpes zoster, diabetic peripheral neuropathy, and vascular insufficiency, has been applied in the treatment of pediatric cancer pain. Most commonly, celiac plexus blockade (CPB) is used to target visceral abdominal pain in the setting of upper gastrointestinal malignancies, such as pancreas, liver, gallbladder, spleen, stomach, and small intestine cancers. Because of its potential adverse effects—ranging from common complications, such as diarrhea and orthostatic hypotension, to rare, catastrophic risks, such as retroperitoneal hemorrhage and paraplegia—CPB is often limited to terminal patients in the pediatric oncologic population.

7.3.2 Epidural Analgesia

Epidural analgesia is employed to decrease cancer-related pain secondary to tumor infiltration that is refractory to escalation in opioid therapy. Epidural analgesia may be performed either as a "single shot" or as a continuous epidural infusion of local anesthetic and/or opioid medication through a catheter. Catheter placement is often preferred, as it provides longer-term therapy. In paediatric patients, the catheter is often tunneled subcutaneously so as to avoid dislodgement during activity and decrease infection risk. A 2013 review of regional anesthesia techniques used in pediatric palliative pain management describes several case studies of epidural analgesia use in patients suffering from neuroblastoma, astrocytoma, metastatic retinoblastoma, pelvic chondrosarcoma, and other pelvic and sacral masses.

7.3.3 Intrathecal Therapies

Intrathecal therapies, such as catheters, implanted pain pumps, and neurolysis, can provide definitive pain relief for pediatric cancer patients and also allow for continued pain control once discharged from the hospital. Intrathecal catheters and implanted pain pumps allow for the continuous infusion of both opioids and local anesthetics, with some case reports describing the addition of such medications as clonidine and sufentanil for pediatric cancer pain. Intrathecal infusions require exponentially smaller amounts of medication than do oral and intravenous routes, thereby decreasing the risk of opioid-induced side effects, such as severe constipation and sedation, which may negatively impact the patient's quality of life.

7.3.4 Cordotomy

Spinal cordotomy is an invasive intervention most commonly used in patients with uncontrollable pain in the setting of malignancy and a short life expectancy. It involves lesioning of the spinothalamic and spinoreticular tract to produce contralateral analgesia at 3 to 4 levels caudally. Owing to its potentially severe adverse effects, it is often performed after failure of traditional therapies, including systemic analgesia and minimally invasive procedures.

7.3.5 Vertebral Augmentation

Vertebral compression fractures are commonly associated with chemotherapy and in some patients can be a source of intractable pain. Balloon kyphoplasty has long been used as a treatment for compression fracture pain in adults. In the pediatric population, there are only a few reports of the use of balloon kyphoplasty. One report described the use of balloon kyphoplasty for the treatment of vertebral compression fractures in three children, two of whom had cancer. The first patient was a 12-year-old boy with metastatic alveolar rhabdomyosarcoma and compression fractures of T8, T10, and T12, causing him 9/10 pain that was refractory to treatment.

Innovation	Key Features	
Peripheral Nerve Blocks	- Local anaesthetic with/without adjuvants	
	- Single injection, repeated injections, or	
	infusion	
	- Effective in paediatric orthopaedic tumour	
	surgery	
Sympathetic Blocks	- Targets visceral abdominal pain	
	- Commonly used for terminal patients	
	- Celiac plexus blockade (CPB) has risks	
Epidural Analgesia	- Used for refractory cancer pain	
	- Single shot or continuous infusion	
	- Catheter preferred for long-term therapy	
Intrathecal Therapies	- Catheters, implanted pain pumps, neurolysis	
	 Provides continuous opioid/local 	
	anaesthetic infusion	
	- Reduces opioid-induced side effects	
Cordotomy	- Used for uncontrollable pain	
	- Lesions spinothalamic/spinoreticular tract	
	- Severe adverse effects limit usage	
Vertebral Augmentation	- Treats vertebral compression fractures	
	- Balloon kyphoplasty used in limited	
	paediatric cases	
	- Reported pain relief in paediatric cancer	
	patients	

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7.3 Family-Cantered and Holistic Care

In pediatric care settings, family-cantered care (FCC) is an integral way to ensure family involvement in their child's care and has been known to improve health outcomes and families' psychosocial well-being. Similarly, nursing presence is deemed beneficial in the formation of authentic nurse-patient relationships and is known to facilitate healing and improve satisfaction for the patient and their family. The objective of this article is to explore how nursing presence supports FCC by closely examining the four concepts of FCC as described by Institute for Patientand Family-Cantered Care: dignity and respect, information sharing, participation, and collaboration. A case study is also presented to demonstrate how nursing presence can be applied in FCC, when caring for a pediatric oncology patient.



Here is a bar diagram representing the importance of nursing presence in family-cantered care (FCC) across four key concepts: dignity & respect, information sharing, participation, and collaboration. Let me know if you need any modifications



This diagram illustrates key elements of patient- and family-cantered care (PFCC), emphasizing collaborative healthcare approaches. It highlights factors such as communication, cultural humility, shared decision-making, and family engagement to enhance patient outcomes and holistic care.

7.4 Technology Making Cancer Care Easier

Childhood cancer is a devastating reality, with **1** in **5** children not surviving, and most survivors facing long-term disabilities from the aggressive treatments. Shockingly, only **12** cancer drugs have been approved for children over the last 40 years, compared to **500** drugs for adults. In Australia, childhood cancer remains the **number one cause of** death among children. These statistics underscore the urgent need for more effective, less harmful treatments, and this is where Artificial Intelligence is stepping in to reshape pediatric oncology. AI is

transforming cancer care by analyzing vast amounts of data, detecting patterns invisible to the human eye, and helping doctors diagnose and treat cancer with greater precision.

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Aspect	Traditional Cancer Care	AI-Driven Cancer Care
Diagnosis	Relies on biopsies, imaging, and pathology reports, which can take time.	AI analyzes medical data, including imaging and genetic information, for faster and more accurate diagnosis.
Treatment Planning	Standardized treatment protocols that may not account for individual patient differences.	AI enables personalized treatment by analyzing genetic markers and predicting patient response.
Drug Development	Limited number of pediatric-specific drugs; slow approval process.	AI accelerates drug discovery by identifying potential compounds and repurposing existing drugs.
Side Effect Management	High toxicity and long- term side effects due to generalized treatments.	AI predicts adverse reactions, allowing for proactive management and reduced toxicity.
Patient Monitoring	Dependent on periodic hospital visits and manual tracking of symptoms.	AI-powered wearables and telemedicine enable continuous real-time monitoring.
Survival Rates & Outcomes	Gradual improvements with traditional approaches.	Potential for significantly improved survival rates and better quality of life through precision medicine.

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This table illustrates how AI is revolutionizing pediatric oncology, offering more effective, personalized, and less harmful treatment options. Let me know if you'd like any modifications!

7.5 Helping Children Thrive After Cancer Long-Term Strategies for Parents

Children often face long-term complications as a result of cancer or the treatments they received. These problems may affect many facets of their lives and their bodies, including their growth, reproductive and sexual development, and lung and heart health. Some children may develop learning difficulties or emotional problems. Childhood cancer survivors are also more likely to develop cancer later in life.

Here are some strategies parents can utilize to help their child thrive:

Develop and follow a long-term plan. Even though cancer-free, your child will need follow-up care throughout life to look for any recurrent or new cancer, as well as side effects or complications from treatment. "It's important to find a provider who is trained in the late effects of childhood cancer to maintain long-term health," says Dr. Hackney. "The follow up is different for each patient and depends on the type of cancer and treatment, overall health status, genetic factors and other health habits."

Keep careful medical records. Be sure to note details of the diagnosis, treatments, side effects and any complications. Provide copies to any new healthcare providers your child visits while growing into adulthood. This medical history is invaluable to understand any future health issues. Ideally, the hospitals that treats your child will provide this at the conclusion of treatment.

Start good habits early. Keep your child robust by encouraging a healthy lifestyle. Teach the importance of avoiding smoking, eating a balanced and nutritious diet, and getting plenty of regular exercise.

Keep your child emotionally fit. You know the emotional toll your child's illness took on you and your child. Nurture emotional well-being by encouraging your child to talk about their feelings. See whether your child is comfortable speaking with a counselor to deal with depression, stress, anxiety or fear of the illness returning. Support groups can also

help young cancer survivors cope with emotional effects. Parents of cancer survivors understand what a precious gift life is. Use that information to make each day a healthy one for your child to thrive.

Bar Diagram-2

Here is a bar chart illustrating the key long-term strategies for parents to help their children thrive after cancer. The strategies include developing a long-term care plan, keeping medical records, encouraging healthy habits, and supporting emotional well-being, each rated based on their importance. Let me know if you need any modifications.

Conclusion

Innovations in pediatric oncology nursing are giving children with cancer the best possible chance at a healthy future. By combining cuttingedge treatments with compassionate care, nurses are transforming lives every day. For example, a young leukemia patient who once feared chemotherapy sessions now finds comfort in the presence of a dedicated nurse who uses distraction techniques, like storytelling and music therapy, to ease his anxiety. Through their unwavering support, nurses not only



administer life-saving treatments but also provide emotional reassurance, making an enormous difference in the healing journey of their young patients. As research continues, the future of pediatric cancer care looks even brighter, bringing hope and healing to children and their families around the world.

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