

Pain Interventions in Pediatric Oncology Patients

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Abstract

Managing pain in the pediatric oncology population can be a daunting task. Often pain in these patients is severe and often not adequately treated or assessed. Studies have found that the reason for this disconnect is due to the impulse to follow unsubstantiated fears and myths held by healthcare professionals and even by the caregivers of the patients. For this reason, many pediatric oncology patients suffer from unnecessary pain when there are both pharmacological and non-pharmacological means available to intervene. The diagnosis and treatment of childhood cancer is multidimensional; however, it can be managed based on recent research and evidence-based practice. In addition, the family, nurses, and other caregivers play a significant role in the management of pain for these young patients. It is imperative that empirical research is conducted and put into practice when appropriate in order to dissipate the burden of such a complex diagnosis. The synthesis of the existing research will help to identify risks and benefits associated with certain medications and treatments as well as identify where gaps exist and further research is necessary. Pediatric oncology patients are affected by their disease in every facet of their lives and would benefit greatly from adequately managed pain.

Pain Interventions in Pediatric Oncology Patients

When a child is diagnosed with a chronic illness such as cancer, challenges are present in just about every aspect of the child's life. The American Cancer Society determined that approximately 11,630 new cases of cancer will present for children under the age of 14 in the year 2013 (American Cancer Society, 2013). That is 11,630 children who will undergo a dramatic alteration in normal day-to-day life. In the field of childhood cancer there are a plethora of unanswered questions and research left to do. One objective that is clear within the literature is that there is a need for more aggressive pain management. Pain still goes widely undermanaged even though for patients and families, pain control is rated second in importance to finding the right diagnosis (Clinical Effectiveness Committee, 2010). Still, studies show that pain persists in up to 50% of patients (Ferreira, Kimura, & Teixeira, 2006). The root of the issue has yet to be identified. Perhaps it is a deficit of knowledge in both nurses and doctors alike. The root of the issue may also lie in the hands of patients and their families who fear the effects of heavy drugs to control pain. Maybe it is the fact that no perfect drug has been found to adequately manage pain without the risks outweighing the benefits. The deficit in treatment is most certainly due to a complex mix of these barriers as well as many others. Ultimately, the management of pain is just as multifaceted as the diagnosis of childhood cancer itself (Christo & Mazloomdoost, 2008; Cramton & Gruchala, 2012; Goddard, 2011; Gupta, Chaudhary, Khurana, Mishra, & Bhatnagar, 2011; Johnston et al., 2007; Loizzo, Loizzo, & Capasso, 2009; Van, Wilkie, & Wang, 2011).

The administration of pain control measures primarily lies in the hands of healthcare professionals. However, researchers show that there are deficits in knowledge about pain control measures, especially with the use and administration of opioids (Christo & Mazloomdoost, 2008;

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Johnston et al., 2007; Rana et al., 2011; Van et al., 2011). Further, myths often overshadow concrete facts and seem to be passed down from one generation of clinicians to the next. More specifically, nurses tend to under medicate and report a low pain score in pediatric oncology patients despite the child's report. These factors that present challenges must be eliminated if children with cancer hope not to endure their diagnoses in pain (Van et al., 2011).

In order to clarify the issues involved with pediatric oncology pain management, many contributing factors will be discussed in detail. Initially, an overview of the pain sensation will be discussed as it pertains to cancer including specific cancer-related stressors. The assessment of pain using the WHO analgesia ladder will follow as well as other scales used to measure pain and the nurse's role in assessment and implementation of pain relief measures. Non-pharmacological interventions will then be explored including the role that the caregiver plays in adding to the pain experience. This section will also discuss chemotherapy, radiation, and other treatment options that often elicit pain. Pharmacological measures will follow and will discuss the specific steps of the WHO analgesia ladder and beliefs that are frequently held regarding medicating pain. This literature review will then conclude with a discussion of findings.

The Pain Experience

Pain in Children

Treating pain in children seems to pose an even more complicated task than treating pain in adults. In the past, the confusion was largely due to lack of information and research. However, the majority of these barriers to effective analgesia management in children have been broken in the past decade; yet improvement in pain control seems has not been as significant. One myth that persisted in the past was that neonates and children could not feel pain as adults could due to immature nervous systems (Cramton & Gruchala, 2012; Gupta et al., 2011; Loizzo

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et al., 2009). However, in recent research, it is noted that pain pathways develop during mid-gestation, and at 26 weeks gestation, much of the peripheral and central nervous system is functional, although still developing to some extent. For example, the myelination of nerve fibers is still in the process of developing. Although decreased myelination slows the conduction of nociceptive pain in children and neonates there is a shorter gap between the point of pain perception and the central nervous system where the sensation of pain is perceived. In fact, current research suggests that because of the early development of the peripheral and central nervous system as well as the synthesis of neurotransmitters like substance P around 15-20 weeks gestation, not only do children and babies feel the sensation of pain, but some researchers believe that there is a chance that they may feel it to an even greater extent than adults (Loizzo et al., 2009). Additionally, before birth, the majority of the development of the central nervous system (CNS) is in the ascending pathways. It is not until after birth that the descending pathways, which are also the inhibitory pathways for pain, are fully developed, thus making pain perhaps even more unbearable in neonates (Kennedy, Luhmann, & Zempsky, 2008).

Pain is always a subjective experience. It is the body's natural reaction to external or internal stimuli and is transmitted to the pain processing center of the brain, the cerebral cortex. Pain is either acute or chronic although some patients, like pediatric oncology patients, deal with both on a continuous basis. During a medical procedure such as a needle prick, the pain sensation is initiated by the stimulation of the specific nerves that supply that area of the body. The body is divided up into dermatomes, or areas of the body that are supplied by specific nerves. From the point of stimulus, the nociceptors, or nerve receptors, send the signal up the nerve, through the spinal column, through the thalamus, and into the cerebral cortex. The body is then able to pinpoint where the pain originated. When the pain originates from the inside, the

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brain may interpret it as a referred pain or a pain felt in a more superficial region or even a completely different region of the body. During the process of pain transmission, there are additional substances like enkephalins and endorphins that regulate the pain response and act as painkillers. On the other hand, there are particles involved like substance P that communicate from one nerve to the next and communicate the pain sensation. Although acute pain is transmitted because of a pain stimulus, chronic pain has a slightly different physiological process because typically the pain does not subside for at least one month. In addition, the pain may originate from within the nerves instead of from an external stimulus (Pain, 2010).

In addition to the temporary experience of pain in children, some studies have shown that pain in infants and children can affect them long-term. Studies of animals have suggested that painful procedures during the neonatal time period, also considered a critical period, can alter the development of the brain and change the neurochemical structures such as the opioid receptor sensitivity. Although the research is not conclusive, it does suggest that infants and children do experience pain and due to shorter nociceptive pathways in combination with a developing brain, pain may be intensified (Loizzo et al., 2009; Pieretti, D'amore, & Loizzo, 1991).

Cancer Pain

One study showed that 14-100% of patients with cancer experience pain (Christo & Mazloomdoost, 2008). In pediatric oncology patients, this pain can originate from tumor invasion, medical procedures, surgery, radiation, chemotherapy, or even self-perpetuating pain with the origin of fear. Yet multiple studies show that even when the disease of cancer itself is life threatening, the main source of pain in these young patients is procedural pain instead of the disease itself (Cramton & Gruchala, 2012; Hildenbrand, Clawson, Alderfer, & Marsac, 2011). For pediatric patients, this type of nociceptive pain is a result of frequent procedures that are

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necessary to treat cancer but bring along the added baggage of fear and unpleasant side effects. Nociceptive pain for pediatric cancer patients can be caused by trauma, surgery, and inflammation, to name a few. Since this type of pain activates pain receptors both on the skin as well as from internal organs, it includes somatic and visceral pain. Bone metastasis is a common source of somatic pain whereas a common example of visceral pain seen in these patients is compression of an organ from a tumor (Christo & Mazloomdoost, 2008). In a study of 84 pediatric patients between the ages of 5-15 years, 31% had nociceptive pain. On the other hand, 14.3% of patients had neuropathic pain, and 54.8% of patients had mixed pain at baseline (Mirshra et al., 2009). Neuropathic pain originates from damage to the nerves, as by tumor infiltration, surgery, or even injury from radiation and chemotherapy. This type of pain is reported as burning, numbing, or like pins and needles. Sensory changes often occur with neuropathic pain, such as a diabetic would experience with neuropathy of the peripheral nerves (Christo & Mazloomdoost, 2008).

Some of the most common sources of procedural pain are from surgery, chemotherapy, and radiation (Christo & Mazloomdoost, 2008; Hooke et al, 2007). Surgery may seem the most obvious to elicit pain because it is a direct insult to the body. Not only can it directly affect nerves and create pain at the surgical site, but post-surgical patients often experience painful inflammation and a slow healing process. Chemotherapy can also affect the nerves as the compounds that make up the chemo can cause peripheral neuropathies. Anticancer compounds such as alkaloids, platinum-based compounds, and antimetabolites can cause toxicity in the body, thus affecting the nervous system. Although toxicity is seen more frequently in adults than in children, the negative effects are still present and still offer a potential cause of pain in these patients. Further, radiation is a common cause of muscle stiffness and muscle pain,

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inflammation especially in the joints, sore skin, or more serious and painful side effects. One such side effect is osteoradionecrosis which occurs when a bone dies and is unable to heal or causes painful injury to the connective tissue, or fascia, that covers the muscles as in myofascial injuries. In the management of cancer, these treatments have to be performed for adequate healing. Although the treatments do help to heal, they also bring along serious side effects that directly or indirectly cause pain. Radiation and chemo are used to rid the body of malignant cells. However, in doing so, healthy cells are also killed which prevents healing in the way the normal healthy body would (Christo & Mazloomdoost, 2008).

Assessing Pain

Assessment and the WHO Analgesia Ladder

Pediatric patients present perhaps one of the biggest barriers to appropriate treatment. This challenge is in part due to the fact that children simply cannot articulate their pain as does an adult. Although it is challenging for the child to adequately communicate pain, a proper assessment made by health care professionals has also been found to be a challenge. Unfortunately, sometimes this is the biggest obstacle, as many studies affirm. Currently, there is not a universal standard for pain assessment. Although in recent years pain has become a fifth vital sign in the United States as well as in Canada, it is still not adequately assessed (Gupta et al., 2011; Johnston et al., 2007).

The World Health Organization (WHO) analgesic ladder has been integral for cancer pain management and is the assessment tool most commonly used since its initial release in 1986 (Christo & Mazloomdoost, 2008). This three-tier system has been shown in one study to be effective in more than 80% of cancer pain in both adults and children (Gupta et al., 2011). In another study, it is suggested that 70-90% of patients experience relief of pain when the WHO

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analgesic ladder is used correctly (Christo & Mazloomdoost, 2008). The WHO analgesic ladder has been shown to work just as well in children as in adults and is therefore a milestone in the care of pediatric oncology patients (Mishra et al., 2009). This system is a series of three steps that are followed to adequately administer pain medications. The first step includes non-steroidal anti-inflammatory drugs (NSAIDs) and other adjuvant drugs used to treat mild pain. The second step increases potency to weak opioids, such as oxycodone, as well as NSAIDs for mild to moderate pain. The third step, and also a common step that pediatric cancer patients find themselves on is for moderate to severe pain and includes narcotics like morphine and methadone (Christo & Mazloomdoost, 2008; Mishra et al., 2009).

In a study of 84 pediatric cancer patients, the WHO analgesia ladder was implemented to test its effectiveness. During this study, about 8.3% of patients were on step 3 at baseline, and by the end of the fourth visit, which was five years later, 82.1% of patients were at step 3. However, it was shown that neuropathic, nociceptive, and mixed pain was decreased when measured by the visual analog scale (VAS). The statistically significant findings in this study demonstrated that pain was reduced as the levels of the WHO increased. In addition, there was no evidence of serious negative side effects, which is often a fear in using medication to treat pain (Mishra et al., 2009).

The use of the WHO analgesic ladder is now known to be the most effective, although some criticism surrounds the fact that pain does not always happen in a logical order and therefore some physicians will add another step to the ladder to compensate (Christo & Mazloomdoost, 2008). In addition, it is imperative for health care providers to be aware that although most pain is combated and managed using this system, side effects still need to be rigorously managed with adjuvant drugs. For cancer pain caused by tumors, cancer-related

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surgery, chemo, and radiation, this scale has shown itself to be relatively successful (Christo & Mazloomdoost, 2008; Mishra et al., 2009).

Assessment Scales

Pediatric pain assessment is a hotly-debated topic. Some believe that children over the age of four are mature enough and able to articulate their pain and that they should be asked what their pain level is (Van et al., 2011). Yet, it has been found that many healthcare providers are negligent in asking their pediatric patients about pain, or if they do ask, they often do not consider the self-report seriously if the patient's behavior does not match the verbal report. The lack of proper pain assessment is thought to be one of the top two reasons for cancer-related pain with the second reason being the lack of aggressive treatments to treat the cancer (Gupta et al., 2011).

Studies show that the lack of standardized pediatric pain assessments in addition to low compliance of assessment from healthcare providers is shocking. In a study of 141 full-time nurses across six different hospitals, it was found that only 22% of their pediatric patients ever had any kind of pain assessment based on chart audits. In addition, their assessments were poorly documented using broad statements such as "complaining of pain," without any real scale, degree, or type of pain being recognized. Further, it was found that analgesics were administered more than assessments were performed. Among the pain medications given were opiates, NSAIDs, and topical anesthetics. Most of these drugs required assessments that were not performed, including the opiates which accounted for over half of the analgesics given (Johnston et al., 2007).

Another study of healthcare providers in the Emergency Department (ED) showed that only 61% of those who used a pain scale used it all of the time (Cramton & Gruchala, 2012).

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The question that faces researchers today is the reason behind this disconnect. Studies of nurses and other healthcare personnel show that there is a lack of knowledge or training about pediatric pain assessment, due partially to the fact that rating a subjective experience presents major challenges, especially in the pediatric population (Cramton & Gruchala, 2012; Johnston et al., 2007; Loizzo et al., 2009).

For pediatric cancer pain to be adequately managed, a standardized method needs to be developed (Gupta et al., 2011). The resistance to medication use for treatment of pain cannot be approached fully until the assessment of pain has taken place. As mentioned before, the age of four is often used as a standard for verbal pain report (Van et al., 2011). However, some hospitals use the Face, Legs, Activity, Cry, Consolability (FLACC) behavioral scale for patients under the age of five, which is a pain assessment scale that relies on behavior to rate pain in young children. For those able to report pain, the Wong-Baker FACES pain scale may be used. This scale was used in a study done in 2008 of patients between the ages of 5-13 for pediatric oncology drug administration (Anghelescu, Ross, Oakes, & Burgoyne, 2008). The FACES scale uses an array of faces varying from no pain (happy face) to the worst pain (crying face). For those older than 13, and sometimes even younger depending on the hospital or provider, a numerical pain scale may be used. Whatever the pain assessment tool may be, some researchers suggest that perhaps having a universal pain tool for appropriate ages would be beneficial to incite change. Just as the implementation of the WHO analgesic ladder brought major changes to pain control for pediatric oncology patients, so could mandatory pain assessments and a universal scale. This idea is especially true for nurses. Nurses should prioritize pain management because they have the greatest amount of time with the patients and therefore can best advocate for their patients (Johnston et al., 2007).

The Nurse's Role in Pain Management

The role of the nurse in pain management cannot be understated. Nurses are more often than not the hands and the feet of the physicians, pharmacists, and other members of the interdisciplinary team who coordinate care for young oncology patients. These nurses undergo a degree of stress and emotional trauma that is experienced to perhaps a greater degree in oncology settings than any other field of nursing. It is pivotal that these nurses are given the proper amount of training and expertise in the area of pain management as it is an area in which these nurses spend a great deal of time. Multiple studies have validated the same barriers and knowledge deficits that nurses have faced over the years. On the other hand, many studies have also proposed plans to eliminate knowledge deficits and offer hope to the field of nursing (Johnston et al., 2007; Van et al., 2011).

It is important to note that beyond job-related duties, nurses have an ethical obligation to manage pain (Johnston et al., 2007). However, many nurses report that there is simply not enough time to assess pain in pediatric patients and do not view it as a priority (Cramton & Gruchala, 2012; Loizzo et al., 2009). Still other studies simply show that there is a sense of fear of the unknown among nurses associated with adjuvant analgesics and opioids and even use the term opiophobia to describe this anxiety (Gupta et al., 2011). Most studies show that there is lack of knowledge about these drugs including side effects, usage, and even basic assessment of their effectiveness and because of this, there is an overwhelming misuse of these medications (Habich et al., 2012; Van et al., 2011). One intervention study of 24 registered nurses working on a pediatric unit in 2011 showed that these nurses administered fewer analgesics than recommended by national standards as well as less than the amount of drugs that were prescribed by physicians therefore leading to dissatisfaction by their patients (Van et al., 2011). In this

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same study, researchers found that the lack of assessment skills and knowledge shown by nurses resulted in them using less reliable measures to evaluate patients' pain including vital signs and behavior. Although these assessments play a key part and can help a nurse determine a young patient's pain level, they are not considered the most reliable especially in patients who are able to verbalize a pain score. Yet the nurses in this particular study agreed that if observable characteristics did not match up to the self-report then they may assess the pain differently. The nurses also agreed that in observing a child who was smiling versus a patient who looked as though he or she was in pain, they would medicate the latter despite the self-report of both of the children (Van et al., 2011).

Studies aimed at improving nursing knowledge about pain interventions agree that the greater amount of training nurses have, the greater the patient outcomes are (Habich et al., 2012; Johnston et al., 2007; Van et al., 2011). One way of improving patient pain outcomes that has been studied is a quick two hour test using the RCP (Relieving Children's Pain) program. In a quasi-experimental study, 24 nurses took a pretest and posttest as part of a three part study to identify the gaps that exist in pain assessments and analgesia knowledge. The RCP theory is based on Kolb's experiential learning theory which focuses on experience as a key element to learning. Questions focused around examinations of self-report, effects of medications as well as effects of unrelieved pain, peak and duration of medications, and other general drug questions. For questions on morphine, hydromorphone, and oxycodone, only 35% answered correctly concerning the medication's peak and only 15% answered correctly concerning the medication's duration. Furthermore, the questions produced inaccurate answers about side effects such as sedation, respiratory depression, and adverse effects like addiction. Although posttest scores did improve, the results still showed a large gap in understanding. Ultimately, this study produced

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positive outcomes with nurses administering more adjuvant analgesics. The only adjuvant analgesic that was not administered more frequently was morphine. However, nurses did give positive reports about the program as did the pediatric patients who reported a lower pain score after the intervention (Van et al., 2011).

A similar study of Pediatric Intensive Care Unit (PICU) nurses and other pediatric nursing staff used a 42-question pretest and posttest design as a method to evaluate evidence-based assessments and management of patients' pain. Attitudes of clinical personnel were evaluated through a modified use of PINKAS (Pediatric Nurses Knowledge and Attitudes Survey Regarding Pain). At a six-month follow-up, the nurses did use standardized assessments and reassessments after furthering their knowledge. However, it was found that the actual administration of drugs and overall patient satisfaction did not significantly improve. In fact over the three study periods (baseline, three months, and six months) a pain report of greater than or equal to 4 was reported in 64 dissatisfied patients. Further, over 75% of patients were not given adequate analgesic administration according to the institution's guidelines. Although this type of study shows that nurses do need intervention to cover the gaps in knowledge, this particular method was shown to be less effective than originally thought (Habich et al., 2012).

In a study of 141 nurses in six different hospitals, knowledge and attitudes of pain in children, frequency of pain assessments, administration of ordered pain medications, and non-pharmacological interventions used during procedures were evaluated. This study took a different approach and used role modeling and one-on-one coaching to improve understanding and attitudes. The thought behind this study model was that over the years, it has been shown that workshops, lectures, and reading-type interventions have been unsuccessful overall in eliciting long-term change. Using information from nurses' audits, the one-on-one coaching

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sessions allowed nurses to talk aloud and actively participate in understanding why a particular action was or was not taken. A few logistics in this study proved to be difficult as meeting one-on-one with the nurses every two weeks for six months was a challenge. However, at the end of the study, pain assessment frequency improved, yet documentation of non-pharmacological interventions did not increase nor did the actual administration of analgesics. Overall knowledge did improve in two out of the three teaching groups. Instructors in the teaching groups were only able to teach about pain interventions once 75-80% patients under the care of a nurse were properly assessed. The study proposed that analgesic interventions may not have improved due to the fact that only one site was able to teach about proper management of pain because assessments were not properly administered in the other teaching groups. The study also suggests that the greater amount of information the nurses were given, the greater the outcome (Johnston et al., 2007).

The question still remains unanswered of how to improve pediatric oncology nurses' knowledge about analgesics and the multifaceted process of pain interventions. It is agreed upon that nurses play perhaps the greatest role in patient care and are likely to be the greatest advocate for these young children. Nurses have been found to report a greater degree of pain and a lower degree of pain control for their patients than other members of the interdisciplinary team. This may be in part due to the amount of time they spend with their patients which leads to a greater understanding on their part of the physical and psychological aspects of unrelieved pain (Cramton & Gruchala, 2012).

Contributing Factors in Pain Management

Caregiver Impact

The role of the caregivers, specifically the parents or guardians of a child diagnosed with cancer, is not to be underestimated when it comes to pain management. Inevitably, pain experienced by a child is a mix of both physical and psychological factors and often treating the child's physical symptoms does not eliminate pain altogether (Mishra et al., 2009). Pain arises from fear, anxiety, and other emotional strain that can be greatly enhanced or diminished based on the responses by the primary caregiver, or in most cases of pediatric patients, the parents. Yet holistic approaches that include family care and treatment are often sparse and do not target the pain experienced by parents who have a child with chronic pain. One qualitative study found that the helplessness felt in mothers is often due to the fact that they cannot heal their child simply by being a 'good parent' and that struggling to accept the loss of a healthy child can impede treatment (Maciver, Jones, & Nicol, 2010).

Recent research suggests that cognitive behavioral therapy used for parents of a child who has a chronic illness can help to indirectly reduce painful symptoms in the child. In a study of parents who have a child with chronic abdominal pain, modifying the thoughts and responses of parents was shown to be helpful and further suggests that this technique could be used in other areas of chronic pain in children (Levy et al., 2010). In essence, by targeting dysfunctional thought patterns in parents, the same issues are often reduced in the child. Some dysfunctional thoughts of parents or other caregivers include the thought that if they focus attention on managing pain that it will take the focus away from fighting the actual disease or that there is no way to alleviate pain and discomfort altogether, and therefore, there is no reason to be transfixed

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on that aspect of management. In a sense, patients and family members feel a pressure to choose between pain management and disease management (Christo & Mazloomdoost, 2008).

It has also been noted that parents need to be assured that their presence and guidance is helpful even if it does not directly heal their child's cancer. For example, creating a calm environment for the child helps to relieve anxiety and fear in children which are two factors that often increase pain. Having a parent present during cancer treatment procedures can help soothe the child and teach the child proper coping behaviors. Studies suggest that allowing the child to have a comfort item or something familiar can help to reduce pain, and the presence of a parent can be just that (Cramton & Gruchala, 2012).

A study in 2011 about the influence of parents on a child's cancer-related pain highlighted the positive effects parents can have on a child if his or her behavior is appropriate. The study used a model that encouraged managing and facing a stressor or painful emotion instead of avoiding it. Further, the study focused on asking three questions related to childhood cancer including the following: what cancer-related stressors are experienced, what coping methods are used, and what type of comfort is employed by the parents of the chronically-ill child. Both the child and the parent reported stressors that could be categorized as cancer treatment and side effects, distressing emotional reactions, disruption in daily routines and activities, and social challenges. Specifically for the child and parent, one of the major stressors was pain. It was found that the better the family communicated to one another about the stressors of cancer treatment, the more successful the family was at handling difficult situations as they emerged. Further, it was shown that the majority of parents approached issues and encouraged their children to behave appropriately and seek social support, which was beneficial to the child. Conversely, the main avoidance technique that parents utilized was distraction.

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The conclusion of the study was the same as many others. The suggestion was to create early family-based interventions and to teach coping techniques to the family as a whole. Further, researchers concluded that parents can diminish painful experiences by setting an example and being open to their children for suggestions in how to handle the pain (Hildenbrand, Clawson, Alderfer, & Marsac, 2011).

Parents and caregivers should also be given useful tools to prevent unnecessary pain and anxiety. For example, different age groups of children require a varying amount of information regarding impending procedures. As a general rule, pediatric patients should be given ample time to process the idea of having a painful procedure done, yet not know too far in advance as not to provoke an unnecessary time of anticipation (Cohen, 2008). Timing and preparation can largely involve the help of the parents and can be one way that they can feel useful. Parents can also decrease pain and replace negative feelings associated with a procedure by offering praise and encouragement after a painful procedure. This praise not only helps decrease current pain, but it can decrease anxiety associated with future procedures (Kennedy, Luhmann, & Zempsky, 2008).

Non-pharmacological Interventions

Cancer provokes pain that is notoriously difficult to treat, especially in children. Physicians have a hard time treating pain in children via narcotics and other drugs, yet they often do not use non-pharmacological means to treat pain. According to the American Academy of Pediatrics, however, pain is most thoroughly treated when the multidisciplinary team approaches pain from multiple angles. This approach includes pharmacological interventions but also includes cognitive, behavioral and physical approaches to managing pain that are specific from patient to patient (Cramton & Gruchala, 2012). Yet research and use of non-pharmacological

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pain interventions are lacking. These interventions can perhaps be some of the easiest to implement with the least number of harmful side effects. In addition to providing a calming and comfortable atmosphere as mentioned above, the literature also suggests using behavioral techniques. Clinicians who make use of these techniques, such as guided imagery, hypnosis, muscle relaxation, and deep breathing, may have better outcomes in managing pain (Cramton & Gruchala, 2012; Gupta et al., 2011; Pain, 2010). Even using appropriate preparation for procedures based on the child's age can help diminish pain, as previously mentioned. Depending on the age of the child, pacifiers, blowing bubbles, playing music, and video games or board games often bring positive outcomes (Cramton & Gruchala, 2012; Johnston et al., 2007).

A literature review compiled in 2011 of chronic pain in children showed that evidence-based research is available in the area of non-pharmacological pain interventions and that clinicians perhaps are unaware of the evidence (Goddard, 2011). The literature review focused primarily on psychological therapies that have been studied. One study in 2010 of 6-18 year old children revealed that cognitive behavioral therapy, relaxation therapy, and biofeedback showed significant promise to children undergoing pain. These psychological methods helped the patients to reduce pain levels immediately after a procedure as well as in follow-up appointments (Palermo, Eccleston, Lewandowski, Williams, & Morley, 2010). While biofeedback works by controlling body functions, cognitive behavioral therapy is the process of identifying beliefs about pain and treatment that are either wrong or negative and correcting them to limit pain. Although this technique normally happens by face-to-face time with a counselor, new research shows that cognitive behavioral therapy can successfully be achieved by using a computerized technique. In fact, one study of 65 children with chronic pain from headaches shows that 63% of patients achieved better pain control using a computerized method. In comparison, relaxation

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was successful in reducing pain in 32% of patients while education helped 19% of patients (Trautmann & Kroener-Herwig, 2010).

In another study of musculoskeletal pain in pediatric patients, researchers concluded that pharmacotherapy is often neither beneficial nor harmful for this sort of pain, a type of pain often felt by pediatric oncology patients. However, non-pharmacological measures that involve psychological techniques in conjunction with physical approaches show positive results when enacted early in the disease process (Clinch & Eccleston, 2009). Fear is also a source of increased pain sensation and a part of treatment that medications cannot often target adequately. However, unresolved fear can lead to long term effects and disability. Often fear can be reduced by the involvement of parents and comfort measures and even by allowing pediatric oncology patients the option of having a treatment room which allows the patient's personal room to be a safe place that is not associated with painful or fearful experiences (Cramton & Gruchala, 2012). Reducing fear in parents and using relaxation techniques and education for parents has also been shown to be invaluable in the overall management of pediatric chronic pain. A study in a gastroenterology clinic showed that parents have a greater degree of satisfaction with their child's assessment and progress when they were referred to a pain clinic and given information concerning issues surrounding pain. The psychological state of the parents has a significant effect on the child as discussed above and therefore the results of studies that explore non-pharmacological options are important to not only the treatment of the parents directly, but for the children as well (Schurman & Friesen, 2010).

If the literature suggests positive outcomes from non-pharmacological pain interventions, then the question stands as to why the techniques are not being put into practice. These interventions are, in most cases, carried out by nurses and can be as easy as repositioning the

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client or using heat or cold techniques. In the same study that used one-on-one coaching for nurses in order to improve pain education and administration of pain interventions, it was found that results varied from hospital to hospital, but overall, increasing knowledge did not increase the use of non-pharmacological pain interventions (Johnston et al., 2007). Perhaps part of the problem is cost of some more expensive interventions. The cost of computerized programs and therapists are often not covered by insurance or hospital agencies which can be disheartening to the already financially-burdened families and caregivers. However, it is important for families and clinicians to take into consideration the cost of treating chronic pain brought on by a cancer diagnosis (Goddard, 2011).

Procedures and Interventions to Minimize Pain

Beyond just medications, cancer pain can be treated using an array of procedures including vertebroplasty, tumor ablation by radiofrequency, surgery, radiotherapy, chemotherapy, and even antibiotics. Perhaps the most common treatments are radiation and chemotherapy. Radiotherapy, or radiation therapy, is the use of high energy rays that aim to destroy malignant cells and has been successful in treating areas of metastases within the bones and brain as well as with epidural neoplasms. Chemotherapy uses cytotoxic drugs to achieve the same results. In the process, however, both chemotherapy and radiation can produce significant side effects that are very limiting and very painful for the patient. These effects are due to the inability of the caustic agents to distinguish between malignant and non-malignant cells. However, there is enough evidence to believe that a certain degree of analgesia is achieved when tumors shrink in response to these methods of cancer treatment. In fact, the release of the pressure from tumor invasion is perhaps one of the greatest methods of pain relief (Christo & Mazloomdoost, 2008).

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Further, radiofrequency ablation has shown to produce beneficial results in patients by using high energy waves to ablate damaged tissue. This treatment has been successful specifically in liver, pelvic, pancreatic, vertebral, renal, and adrenal cancer. Vertebroplasty is another procedure that uses a percutaneous injection of methylmethacrylate into a painful vertebra caused by a tumor-induced compression fracture. The injection solidifies the lesion providing relief of pain within 1-3 days. Of course, surgery is also another common way of treating cancer by either directly removing a tumor that is causing compression or obstruction or by using other surgical procedures, such as stent placement, to indirectly allow for the relief of pain. Even antibiotic therapy can be used when a source of cancer pain is from an infection, which is very common in patients with a compromised immune system (Christo & Mazloomdoost, 2008).

Neuropathic pain can also be interrupted and relieved using neuroablation techniques either by the temporary use of anesthetics as in a peripheral nerve block, or by permanent methods that destroy the pain-transmitting sympathetic nerves completely as by the use of alcohol, phenol, or surgery. The majority of these procedures used to minimize pain have shown to be successful in the treatment of cancer, yet they often inevitably involve the use of drugs to manage side effects and to achieve the desired result (Gupta et al., 2011; Pain, 2010).

Pharmacology

Pharmacology Beliefs

Throughout history, treating pain in children by using medication has been a serious barrier to proper analgesia. In the past, this obstacle was largely due to legitimate fears of side effects that could be harmful or potentially deadly to such young children with developing bodies. However, as research has emerged and evidence-based practice suggests otherwise,

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perhaps the barrier is now due to unsubstantiated fears. Indeed there is an overwhelming lack of knowledge that needs to be addressed (Van et al., 2011; Gupta et al., 2011; Johnston et al., 2007; Christo & Mazloomdoost, 2008). Unless clinicians and patients alike have a proper understanding of the function and methods of opioids, it is unlikely that optimal pain relief will ever be accomplished in children (Van et al., 2011).

As previously discussed, the WHO analgesic ladder has been the mainstay of cancer pain relief for adolescents and adults alike. The second and third steps involve the administration of opioids which are to be used in severe pain or in pain that is terminal. Although other adjuvant analgesia drugs are used first, with a diagnosis of cancer, the first step of the WHO analgesia ladder is quickly passed and heavier drugs are needed (Pain, 2010). Some studies suggest that for a diagnosis of pediatric cancer, pain from symptoms in advanced stages should be treated by an opioid regardless of the mechanism of pain (Christo & Mazloomdoost, 2008). Clearly the need for proper understanding of narcotics is imperative to a clinician who is to treat a child with cancer. Two of perhaps the most dangerous side effects that are feared, especially in children, are addiction and respiratory depression (Cramton & Gruchala, 2012; Loizzo et al., 2009). However, recent evidence has shown that addiction is typically only found in 0-7.7% of patients and that relief of pain is experienced in patients before respiratory compromise becomes an issue (Christo & Mazloomdoost, 2008). Other side effects that are feared are neurological issues like sedation that may come from drug use especially in the youngest populations (Cramton & Gruchala, 2012; Van et al., 2011).

Further, barriers exist outside of the realm of hands-on clinicians. Heavy regulation of narcotics is often difficult to bypass and therefore can make physicians reluctant to use those measures even when they are needed. This intense regulation includes refilling prescriptions for

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opioids, proper documentation to satisfy the request of an opioid, as well as telephone calls and time spent getting approved for the use of narcotics (Christo, & Mazloomdoost, 2008; Gupta et al., 2011). In 1973, when opioid receptors were found in the central nervous system, cancer patients were still suffering in the final stages of the disease with intense pain. In 2013, this should no longer be the case and education about pharmacological and non-pharmacological pain management needs to be increased (Christo & Mazloomdoost, 2008).

Step One of the WHO Analgesia Ladder

Step one of the WHO Analgesia ladder involves co-analgesics as well as adjuvant analgesics. Co-analgesics are drugs that have not been guaranteed to show significant relief in the cancer pain population but rather are more common to be used in non-malignant patients (Christo & Mazloomdoost, 2008). This is a category of drugs whose primary purpose is not to produce analgesia. Instead, they have been shown to either have analgesic properties or other effects that ultimately give pain relief. They include drugs such as corticosteroids, topical local anesthetics, antidepressants, anticonvulsants, bisphosphonates, radiopharmaceuticals, some psychoactive substances, as well as sedatives and anxiolytics (Christo & Mazloomdoost, 2008; Cramton & Gruchala, 2012). Corticosteroids, most frequently Dexamethasone due to its low risk of dangerous side effects and long half-life, act by reducing edema by inhibiting prostaglandin synthesis. They are frequently used in patients who have intracranial pressure headaches, superior vena cava syndrome, compression on the spinal cord as by tumor invasion, bone pain and hepatic capsular distention from metastases, plexopathies, and inflammation of the lymph nodes. Topical local anesthetics are also a common co-analgesia for young patients. They can be used for procedural-type pain such as a lidocaine injection for lumbar punctures used in the diagnosis of cancer or for painful lesions on the mucosa or skin (Christo & Mazloomdoost, 2008;

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Cramton & Gruchala, 2012). In fact, needle sticks, finding a port access, and spinal taps are among the major child stressors due to pain, all of which can be lessened by topical local anesthetics which are typically quick-acting but produce positive results (Hildenbrand et al., 2011).

Antidepressants, another commonly used co-analgesic, are successful at treating neuropathic pain. This is especially true for tri-cyclic antidepressants (TCAs). TCAs are commonly used for pain associated with surgery, chemotherapy, radiation, or tumor infiltration of nerves. Further, the inability to sleep is often another problem suffered by pediatric oncology patients and antidepressants can help by promoting sedation. Although selective serotonin reuptake inhibitors (SSRIs) are less commonly used due to their inability to produce analgesia, they may be administered due to a lower risk of side effects and adverse reactions in comparison to TCAs. Anticonvulsants are also used for neuropathic pain that is described as shooting, stabbing, or burning pain. Because cancer can damage the nervous system due to infiltration of tumors or destruction or interruption of nerves, the pain can often be severe. Although the mechanism of action of the drug is not completely understood when it comes to nerve pain relief, it is believed that it perhaps slows the pain signals when they are transmitted to the central nervous system (Christo & Mazloomdoost, 2008; Gupta et al., 2011).

Two types of co-analgesics that are effective for treating bone pain are bisphosphonates and radiopharmaceuticals. They are frequently used because when it comes to bone pain, which one study suggests is the source of 90% of cancer-related pain, most drugs seem to fall short, even opioids (Gupta et al., 2011). Bisphosphonates help to maintain bone density and strength by inhibiting the destruction of bone by osteoclasts, thus offering analgesia for areas of metastases and bone infiltration. In controlled trials, they have been shown effective in the

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reduction of pain in patients with advanced cancer (Christo & Mazloomdoost, 2008). Further, in some cases, bisphosphonates can be used to treat challenging spontaneous pain, which is considered the hardest type of pain to adequately treat (Gupta et al., 2011).

Radiopharmaceuticals work by injecting radiation via IV that accumulates in areas of bone metastases and destroys the malignant cells. Studies have shown that certain radiopharmaceuticals, such as strontium and samarium, can help in pain management by reducing bone pain for 6 months or more in 60-80% of patients (Christo & Mazloomdoost, 2008).

Anxiolytics and sedatives work in similar ways and function as co-analgesics. They are both an important part in the drug cocktail for procedural pain management; however, they do not directly achieve analgesia. Yet as previously discussed, fear can lead to increased pain and long term disability, even post-traumatic stress disorder which is more commonly found as a long-term effect in pediatric oncology patients who are living longer and surviving cancer (Cramton & Gruchala, 2012; Hildenbrand et al., 2011). In addition, drugs like TCAs promote sleep, thus combating yet another potential effect of pain (Christo & Mazloomdoost, 2008).

Adjuvant analgesics are almost always used immediately when pain presents in the early stages of a cancer diagnosis. These include any drugs under step one of the WHO analgesic ladder such as acetaminophen, any NSAID, and COX-2 inhibitors. These drugs are mostly prescribed as over-the-counter agents that can only give a certain degree of pain relief. A ceiling effect occurs when the maximum therapeutic dose is reached in which there cannot be any more positive effects of the drug use and where toxicity of the drug is a likely possibility. This line is perhaps one of the greatest barriers to the use of the step one drugs and why the advancement to step two is common in cancer patients. However, these drugs are still key to complete pain

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management in advanced cancer, and without them, optimal pain relief cannot be reached, in part due to the fact that strong opioids can produce negative effects themselves which can be managed by adjuvant analgesics (Gupta et al., 2011).

NSAIDs are perhaps the most common adjuvant analgesic used in the treatment of cancer in adults and children alike and are considered a mainstay of treatment (Gupta et al., 2011). In a study involving 84 pediatric patients with cancer, the WHO analgesia ladder was implemented to show its effectiveness. At three regular intervals, the patients were evaluated based on their level on the ladder. Overall, the amount of NSAIDs and other adjuvant analgesics increased with time. The study concluded that aggressive use of these adjuvant drugs is necessary for pain relief and management of side effects (Mishra et al., 2009).

Steps Two and Step Three of the WHO Analgesia Ladder

Steps two and three of the WHO analgesic ladder include the use of mild to strong narcotics in addition to adjuvant drugs. Step two represents weak opioids like codeine, oxycodone, tramadol, and dihydrocodeine. Most of the drugs found in this level are schedule V drugs which are those that have a low abuse potential and are widely accepted for medical use without extensive regulation. This is in contrast to schedule I drugs which have a high abuse potential and typically have no use for medical purposes. Step two drugs like tramadol work in the same way that step three drugs work, such as morphine, and even bind to mu opioid receptors which are the same receptors to which morphine binds. However, these drugs have a very low risk of respiratory depression which is why they are preferred. The downfall is that their ceiling effect is reached before optimal pain relief is felt in pediatric patients with severe and intolerable pain such as in the terminal or advanced stages of cancer (Christo & Mazloomdoost, 2008).

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Step three of the WHO analgesic ladder involves drugs that are considered strong opioids and are used to treat moderate to severe pain, which is typically expressed as a pain of 6-10 on the numeric scale. This step includes the most common drug used in the treatment of cancer, morphine (Gupta et al., 2011). In addition, hydromorphone, fentanyl, buprenorphine, methadone, and oxymorphone are all step three drugs. Most of these drugs are a synthetic or semisynthetic derivative of morphine. Hydromorphone is a semisynthetic morphine that is six times more potent chemically and also more likely to have undesired side effects when used. Fentanyl is 100 times more potent than morphine but is commonly administered via the transdermal route. Methadone has a prolonged half-life which can make it a more dangerous drug in the treatment of cancer because it is more likely to cause an overdose in repeat administration. This is less of a risk for morphine because of its relatively shorter half-life. Certain drugs like oxymorphone with an extremely short half-life are optimal for treating breakthrough pain. These drugs have specific characteristics and are potentially deadly because of their side effects. They are desirable because they have been shown to treat cancer pain in children, however their dangerous side effects produce a rather thin line that clinicians, parents, and patients alike have a fear crossing (Christo & Mazloomdoost, 2008).

The debate in the literature is whether the fears of using heavy opioids are substantiated enough to discourage their use. Millions of pediatric patients with childhood cancer are surviving in pain and also dying in extreme pain. The response from the literature is that choosing to undermedicate pain is detrimental. Instead, in studies of children with cancer, relief from pain is reached before respiratory depression, addiction, sedation, or other deadly side effects are experienced (Anghelescu et al., 2008; Christo & Mazloomdoost, 2008). In controlled studies, when negative reactions occur, it is normally due to an overdose or other medication

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administration error. One study helped to unveil this fear by doing chart audits. In the ED, 39% of nurses requested treatment of pain assessed as moderate to severe. However, only 22% of physicians ordered pain medication (Harrison et al., 2011).

There are options available to physicians that allow for more control in the administration of morphine and other opioids instead of the traditionally oral route. For example, intrathecal morphine pumps or spinal cord stimulators can be used when a pediatric patient experiences excessive side effects of drugs used and these methods can significantly improve the patient's quality of life (Gupta et al., 2011). One such study in 2008 at St. Jude Children's Research Hospital suggests one method. The study was on the safety of opioid administration through epidural methods as well as intravenous routes at the same time, specifically for pediatric oncology patients suffering from postoperative pain. The study recognized that treating pain is extremely tricky for these patients. Often adjuvant drugs are unappealing. For example, NSAIDs may be avoided for pain because they have antiplatelet effects, therefore increasing the bleeding risk, especially for children who are undergoing chemotherapy. In addition, any adjuvant drugs that have antipyretic properties can also be dangerous because they can mask a fever which is important to catch in patients who are neutropenic, which represents the majority of pediatric oncology patients, especially those in chemotherapy or radiation therapy. This study suggests that although respiratory depression and sedation are thought to occur more frequently in epidural opioids, that under regulation and surveillance, this was not the case. Overall the risk of epidural opioid-induced respiratory compromise is only 0-25% in children. For 117 patients, epidural bupivacaine and fentanyl were given via an epidural infusion and each patient had a medication order for intravenous PRN (as needed) opioids. The PRN medications included morphine, fentanyl, and hydromorphone with morphine being the first-line therapy used. Some

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patients were given intravenous patient controlled analgesia (IV PCA) if they had a history of difficult-to-control pain or opioid tolerance (Anghelescu et al., 2008).

Although dual-opioid routes are normally avoided, only 0.85% of patients experienced respiratory depression and this small percentage was experienced in an infant who was given 5mg of morphine instead of 0.5mg. Two patients ages 14 and 17 had low respiratory rates but were substituted IV PRN morphine for IV PCA morphine. The respiratory rates were not excessively low, supplemental oxygen was only used for one patient experiencing pleural effusion, and the use of Naloxone as an antagonist for morphine was never used. For those who did suffer consequences, the researchers concluded that the patient's overall co-morbid condition and factors specific to the patient were significantly linked to the reason for respiratory compromise (Anghelescu et al., 2008).

The researchers concluded and defined reasons for using such unconventional measures. The researchers at St. Jude's explained that there are a limited number of agents to use in the treatment of cancer pain. NSAIDs and antipyretic drugs, like Tylenol are effective but can exacerbate bleeding, mask infection, and even interact with chemotherapeutic agents, as mentioned previously. In addition, the patients at St. Jude's often have a degree of tolerance to opioid therapy due to the fact that they require chronic opioid pain control. Thus, more aggressive therapy is warranted (Anghelescu et al., 2008).

Of course, it is important to note that St. Jude's Hospital has a low nurse-patient ratio which makes for a more conducive environment to eliminate drug administration errors. In a different setting, having two routes of opioid administration can significantly increase the number of dangerous mistakes. However, this study did conclude that in an appropriate environment, having two routes used to treat pain can be very successful (Anghelescu et al.,

2008). Yet this issue of large nurse to patient ratio or staff shortages is one of the deficiencies that creates a barrier to adequate pain relief (Cramton & Gruchala, 2012).

Further, results of different studies on the negative effects of opioids may differ based on the definition of the terms. For example, the study at St. Jude's Hospital pointed out that respiratory depression is defined by different terms and can vary depending on whether it is defined by the use of naloxone, morphine's antagonist, or simply just a decreased oxygen saturation or decreased respiratory rate, and by what interval is required to call an episode respiratory depression (Anghelescu et al., 2008). Addiction may also be defined differently from institution to institution. As a general definition, however, it is defined as behavioral observations that suggest dependence on a drug. These behaviors may include loss of control over the need or use of the drug, obsession over obtaining the drug despite proper analgesia, psychological dependence, and other neurotic drug-related behaviors (Christo & Mazloomdoost, 2008).

However the terms are defined, research and evidence-based practice suggest that physicians may be doing more harm to their patients by not administering appropriate medications than they are by being overly conservative in the ordering of narcotics. Further, it is thought that pain acts as an antagonist to the respiratory-depressant effect that opioids may have (Gupta et al., 2011). With all of this in mind, in an appropriate environment, there are plenty of beneficial effects of opioids and relief for pediatric patients who have reached the third level of the WHO analgesic ladder. For patients with chronic pain, parents and physicians do not have to choose between the treatment of the disease and the ease of pain. Instead parents can work hand in hand with clinicians if there is proper education and proper resources for nurses and other members of the interdisciplinary team to use. In fact, by educating the whole interdisciplinary

team of available therapies and alternative medication routes and non-pharmacological measures, a barrier to undermanaged pain could be crossed (Christo & Mazloomdoost, 2008).

Pharmacological Interventions During the Active Dying Process

Pain experienced during the actively dying stage of terminal pediatric cancer is perhaps the most unbearable. It is an emotionally unstable time for families and at times even emotionally draining for long-term clinicians in the hospital. Many patients are still dying in extreme pain which can worsen the emotional pain experienced during this time for the patient and the family. A study published in the *Journal of Pediatric Oncology Nursing* described one method of pain control that offers promise to relieve pain during this time (Hooke et al., 2007). This study served to evaluate the negative or positive effects of using propofol as an adjuvant drug. Within one year, nine patients were administered propofol at the end of life. Each of these patients was experiencing severe pain and agitation at the time of administration that was not being well-controlled by other common drugs like opioids and benzodiazapines. Typically, propofol is not used because of its side effects that may appear after an extended time of usage. Instead, it is usually used for procedural sedation or general anesthesia and is more prone to elicit negative side effects if used for an extended period of time. For the nine patients, the average number of days that propofol was administered was five days before death. Five of the patients experienced agitation, two experienced hallucinations, and one experienced twitching. All side effects were managed well by the added administration of benzodiazapines and the lowering of the propofol dosage except in one case of a patient who experienced tetany and had to have propofol temporarily stopped (Hooke et al., 2007).

As a result of administering propofol, the patients were more comfortable and more alert in their final days and hours and in significantly less pain. Before they were given propofol, the

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patients were suffering from nerve compression, bone metastasis, organ capsule expansion, and increased intracranial pressure. Typical measures would call for an increase in opioids, especially for those suffering from nerve compression. However, in only two cases was there a need for increased opioids. The conclusion of this study was that the use of propofol at the end of life may be a very beneficial measure due to the fact that its side effects are easily controllable and that it actually works as an antiemetic which on top of all other medications is another type of drug that pediatric oncology patients need (Hooke et al., 2007).

Drugs that are typically used for sedation or general anesthesia, such as propofol, lidocaine, and ketamine, are all ones that hold promise to be used for the end of life. Each patient experienced a significant decrease in the level of sedation as he or she would with opioids. The importance of this drug in addition to the pain relief it offers cannot be underestimated for the end of life. As adjuvant drugs, they are yet another option available to physicians instead of an increase in opioids that can have dangerous side effects and can actually shorten the life of a compromised pediatric oncology patient.

Conclusion

After a comprehensive review of the literature, in every area of pain management for pediatric oncology patients, there seems to be a strong drive towards following tradition versus following evidence-based practice. Beliefs and deficiencies exist because of stigma and because of conventional thinking, and much of these thoughts seem to exist with pediatric cancer treatment. Children are still dying in an intense amount of pain due to ignorance and due to the ease and safety of not pushing boundaries. In a study about pain management for these young patients, it was found that when the family and patient were given appropriate facts about an upcoming painful experience so that the outcome matched what they had been prepared for, it

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increased satisfaction. In addition, when the patients were able to express their pain, have it recognized by clinicians and treated within a timely, caring, and knowledgeable manner, and were able to be a part of their own pain management, there were more positive reports by the patients (Habich et al., 2012). However, the majority of these interventions cannot be realized if barriers continue to exist in assessment and management of pain.

The obstacle then remains of how to break down these barriers and bring current knowledge to such a large and diverse audience. Studies show that the main stressors for childhood cancer include hair loss, needle sticks, medications, sleeping problems, port access, and spinal taps. Overall, cancer treatments evoke more stress than the actual diagnosis. For parents, the story is the same because of the pain their children endure during procedures (Hildenbrand et al., 2011). Some studies offer a solution to break down barriers for the young patients. Discussing pain management at the time of diagnosis and scheduling follow-up appointments in a pain clinic may prove to be beneficial (Gupta et al., 2011).

As far as nurses, physicians, and other members of the interdisciplinary team are concerned, educational efforts pose the greatest hope for change. A study that offered one-on-one coaching to nurses about pain in pediatric patients did not show major improvements due to the inaccessibility to schedule coaching sessions. The inability was in part due to the lack of willingness to participate. This lack of interest also presents the fact that the importance on this subject is perhaps not shared among all clinicians (Johnston et al., 2007). However, there are alternative ways to bring attention to such an important matter, and unless other methods of education are explored, ignorance will persist and children will remain in pain (Christo & Mazloomdoost, 2008). Two priorities that one study of pain in children explains are to educate using training programs and a multi-disciplinary team. Allowing experts on pain management to

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be involved on interdisciplinary teams will allow the team to be more well-rounded. The study goes on to explain that palliative care teams need to have pain experts involved and until that intense need is recognized, children on oncology units will continue with sub-optimal pain management (Loizzo et al., 2009).

In addition, more research should be compiled in order to appropriately target areas where improvements can be made. This is especially true in the area of end-of-life care for childhood cancer. There is minimal research done on this topic, although there could be potentially more options than propofol or the continuation of medications used during the disease's progression. Further, it would be beneficial for more research to be done on pediatric cancer patient satisfaction. In two studies on Hospital Consumer Assessment of Health Providers and Systems (HCAHPS), it was shown that pain was a major issue in dissatisfaction of hospital admittance (Hanna, Gonzalez-Fernandez, Barrett, Williams, & Pronovost, 2012; Martin, Kelly, & Roosa, 2012). In one study, it was suggested that the better pain management resulted in higher patient satisfaction. Interestingly enough, even if pain was not adequately controlled, the attempt by the health care providers to do everything possible to manage pain resulted in even higher scores (Hanna et al., 2012). The second study involved a hospital that was in the 1st percentile in HCAHPS score and by taking initiative to manage pain, was in the 90th percentile within five months (Martin et al., 2012). Both of these studies were done on adult patients but one might expect to find similar results in pediatric patients. Perhaps more studies on pediatric patients' satisfaction would bring more attention to the issue of pain management.

The multifaceted issues that children with cancer face are overwhelming. Pain is a major part of this diagnosis, and research has shown that this pain can be better managed. Patients do not have to choose between fighting the cancer and fighting the pain. Whether pharmacological

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or non-pharmacological, there are options and there are solutions to fighting cancer pain. A more holistic view of cancer itself, including the family and caregivers in the plan as well as offering them help and knowledge, and using available medications and treatments to their full potential are just some of the ways that childhood cancer can become a little less painful.

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