

Case Study Report of Master A.A with Osteomyelitis and Pathological Fracture

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Abstract

This case study is about Master A. A, a 4 year old boy with sickle cell disease who was diagnosed of osteomyelitis with pathological fracture of the right humerus. Patient has been hospitalised before for dactylitis on the 7th July, 2015, was treated and discharged home on the 16th July, 2015. He was however readmitted via Children Outpatient Department of Oni and Son Memorial Hospital, Ibadan, Nigeria on the 21st July, 2015 on account of history of fever of 6 days duration and swelling of the distal 2/3 third of the left forearm, there was also swelling of the right upper hand which was associated with pain and loss of function. A provisional diagnosis of osteomyelitis with pathological fracture of the right humerus was made by the doctor in charge. He was later reviewed by the paediatric team and was admitted into Ward I for further investigations and proper management. Afterwards, Master A, A had cast applied on the right humerus due to the fracture as confirmed by the X-ray report. Nursing management was carried out by adopting Quality Care Model which was proposed by Duffy J. R (2005).

Keywords: *Sickle cell disease, Osteomyelitis, Pathological fracture, Master A. A*

Background to patient's case study

This case study is about Master A. A, a 4 year old boy with Sickle cell disease (SCD) who was diagnosed of osteomyelitis with pathological fracture of the right humerus. He lives with his parents at No.2, Peace Street, Akaru, Oluyole extension, Ibadan, Oyo State. Nigeria. First contact with the client was in Ward I, Oni and Sons Memorial Hospital where he was admitted for proper management. The objectives of this case study is to have current knowledge and skills about management of patients with osteomyelitis and pathological fracture in SCD paediatric patient and to utilize the opportunity of nursing process to provide individualized care for the patient.

Introduction

Osteomyelitis is an inflammation of the bone caused by an infecting organism although bone is normally resistant to bacterial colonization, events such as trauma, surgery, presence of foreign bodies, or prostheses may disrupt bony integrity and lead to the onset of bone infection (Robbinson, 2014). Osteomyelitis can also result from hematogenous spread after bacteremia. When prosthetic joints are associated with infection, microorganisms typically grow in bio-film, which protects bacteria from antimicrobial treatment and the host immune response. Early and specific treatment is important in osteomyelitis, and identification of the causative microorganisms is essential for antibiotic therapy. The major cause of bone infections is Staphylococcus aureus (Wright & Nair, 2010). Infections with an open fracture or associated with joint prostheses and trauma often require a combination of antimicrobial agents and surgery. When bio-film microorganisms are involved, as in joint prostheses, a combination of rifampicin with other antibiotics might be necessary for treatment (Concia, Prandini, Massari, Ghisellini, Consoli & Menichetti, 2010).

A pathologic fracture on the other hand is a bone fracture caused by disease that led to weakness of the bone structure. This process is most commonly due to osteoporosis, but may also be due to other pathologies such as: sickle cell disease cancer, infection, inherited bone disorders, or a bone cyst (Arkader & Dormans, 2010). Only a small number of conditions are commonly responsible for pathological fractures, including osteoporosis, osteomalacia, Paget's disease, osteitis, osteogenesis imperfecta, benign bone tumours and cysts, secondary malignant bone tumours and primary malignant bone tumours. Pathological fractures present as a chalkstick fracture in long bones, and appear as a transverse fractures nearly 90 degrees to the long axis of the bone. In a pathological compression fracture of a spinal vertebra fractures will commonly appear to collapse the entire body of vertebra. In circumstances where other pathologies are excluded (for example, cancer), a pathologic fracture is diagnostic of osteoporosis irrespective of bone mineral density (Arkader & Dormans, 2010). Pathological fractures of the long bones are a common complication of metastatic disease caused by a variety of primary malignant tumours (Zimmerli & Sendi, 2011). Pathological fractures are fractures that occur in abnormal bone. Although the term can be used in the setting of a generalized metabolic bone disease, it is usually reserved for fractures through a focal abnormality.

Pathological fracture in children

Pathological fractures in children can occur as a result of a variety of conditions, ranging from metabolic diseases and infection to tumours (Dormans & Pill, 2002). Snyder, Hauser-Kara & Hipp (2006) suggested that fractures through benign and malignant bone tumours should be recognised and managed appropriately by the orthopaedic surgeon. The most common benign bone tumours that cause pathological fractures in children are unicameral bone cysts, aneurysmal bone cysts, non-ossifying fibromas and fibrous dysplasia. Although pathological fractures through a primary bone malignancy are rare, these should be recognised quickly in order to achieve better outcomes. They stated further that, pathological fracture should be suspected in a paediatric patient when there is a fracture associated with minimal trauma, when the location of the fracture is unusual or when an abnormal process in the bone is seen in the radiographs. Supporting this notion, Dormans & Pill (2002) documented that, intrinsic processes, such as changes in the mineral density of the bone from bone tumours (both benign and malignant), diseases like osteogenesis imperfecta, or infection; and extrinsic processes, such as internal fixation, biopsy tracts and radiation, can cause changes to the normal biomechanics of bone. The altered strength of the bone and the load applied are the factors that will determine the risk of a pathological fracture (Dormans & Pill 2002; Snyder, Hauser-Kara & Hipp, 2006). Pathological fractures are often associated with pain and deformity and can be differentiated into micro- or macro-fractures. Micro-fractures most commonly occur in trabecular bone in the metaphysis or vertebral bodies and are typically non-displaced. Many of these go unrecognised (Dormans & Pill, 2002). A thorough history, physical examination and review of plain radiographs are therefore crucial to determine the cause and guide treatment (Jackson, Theologis, Gibbons, Mathews, & Kambouroglou, 2007). In most benign cases the fracture will heal and the lesion can be addressed at the time of the fracture, or after the fracture is healed. To treat these fractures appropriately, a comprehensive approach must be used, and attention to detail is paramount (Peabody & Simon, 1996).

What is sickle cell disease (SCD)?

Sickle cell disease (SCD) is a group of well-defined hemoglobinopathies involving abnormal alternation of the globin moiety. The molecular basis of SCD has been demonstrated to be the substitution of valine for glutamic acid in the sixth position from the N-terminus of the beta chains of hemoglobin (Hb) (GBD, 2014). Decreased oxygen causes the Hb molecules to form insoluble tetramers, which subsequently polymerize, causing deformation of the red cell membrane into a sickled shape. The result is a red blood cell that

is less able to transverse the capillaries of the microcirculation, disposing the end organ to hypoxia and ischemic damage when sickle cells are present in sufficient quantity. Common genotypes include homozygous S mutation (sickle cell anaemia, HbSS disease), heterozygous combinations such as HbS and HbC (HbSC disease), and beta-thalassemia mutation (HbS-beta-thalassemia) (GBD, 2014).

Almost 300,000 children are born with a form of sickle-cell disease every year, mostly in sub-Saharan Africa, but also in other parts of the world such as the West Indies and in people of African origin elsewhere in the world. In 2013 it resulted in 176,000 deaths up from 113,000 deaths in 1990 (GBD, 2014). The condition was first described in the medical literature by the American physician James B. Herrick in 1910, and in the 1940s and 1950s contributions by Nobel prize-winner Linus Pauling made it the first disease where the exact genetic and molecular defect was elucidated. Sickle-cell disease may lead to various acute and chronic complications, several of which have a high mortality rate (Yawn, Buchanan, Afenyi-Annan, Ballas, Hassell, James et.al, 2014). Three quarters of sickle-cell cases occur in Africa. A recent WHO report estimated that around 2% of newborns in Nigeria were affected by sickle cell anaemia, giving a total of 150,000 affected children born every year in Nigeria alone (WHO, 2010). The carrier frequency ranges between 10% and 40% across equatorial Africa, decreasing to 1–2% on the North African coast and <1% in South Africa. (WHO, 2011) There have been studies in Africa that show a significant decrease in infant mortality rate, ages 2–16 months, because of the sickle-cell trait. This happened in predominant areas of malarial cases (Oniyangi & Omari, 2006; Aidoo Terlouw, Kolczak, McElroy, ter Kuile, Kariuki et al.2002).

Investigations carried out on the patient, results and their significance

Haematology

DATE	INVESTIGATION	RESULTS	NORMAL READINGS	SIGNIFICANCE OF RESULTS: HIGH, LOW, NORMAL
27/7/15	x-ray	Fractured bone with fragment on the upper 2/3 of the right humerus		Revealed fracture right humerus
28/7/15	Pack Cell Volume	20%	Male-40-54% Female-37-50%	Low
28/7/15	White Blood Cell	8,700 cells/mm ³	4000-10000 cells/mm ³	Normal
28/7/15	Neutrophil	28%	20-50%	Normal
28/7/15	Lymphocytes	72%	20-50%	High
28/7/15	Eusinophil	00%	1-8%	Low
28/7/15	Basophil	00%	0-1%	Normal
28/7/15	Monocytes	00%	2-10%	Low
28/7/15	Blood group	ARh D Positive	A, O, B, AB	Normal
28/7/15	Haemoglobin genotype	HbSS	Hb AA, AS	Abnormal

Source: Patient's case note number 1278540 August, 2015

Parasitology

DATE	INVESTIGATIONS/TESTS	RESULTS	NORMAL READINGS	SIGNIFICANCE OF RESULT: HIGH, LOW, NORMAL.
	Malaria parasite	-	-	Normal

Source: Patient's case note number 1278540 August, 2015

Management of master A. A

Ethical consideration

Informed consent was taken from the mother to present this case study in a conference and for possible publication. In addition, permission was granted by the Management of Oni and Son Children Hospital, Ibadan, Oyo State, Nigeria to be involved in the care of Master A. A for a period of 6 weeks while on clinical posting.

Nursing management

The Quality Care Model (QCM) Theory was adopted in the care of Master A. A. According to Duffy (2005), knowledge of caring relationships is a significant issue for nursing. The theory emphasises the importance of quality care and that through caring relationships, nurses interact, connect, and come to know the meaning of illness, beliefs, and preferences of the patient and families. The QCM assumes that feeling cared for is a positive concept and is desired by recipients of the health care process. It also defines persons as "multi-contextual beings who are connected to the larger pluralistic world (Duffy, 2005; Duffy & Hoskins, 2003) Furthermore, persons are viewed in relation to one another, and thus are interdependent with others, the model suggests that feeling cared for occurs as a result of caring interactions, and that receiving quality healthcare is a patient expectation. It is also contextual and specific to each individual patient; no two are the same.

Applying Duffy's theory, Master A. A was nursed in a conducive therapeutic environment in Ward I of Oni and Son Children Hospital along with other patients. He was made comfortable on bed with required provision to meet his daily needs. His physical and nursing care were met by the nurses and other care giver especially his mother through guiding; directing, and teaching. These approaches strengthen his care in the contemporary concept of health promotion and health maintenance towards recovery.

Conservative treatment

Prescribed medication on admission

DRUG	ACTION	NURSING IMPLICATION	ADVERSE EFFECT
Intravenous Pentazocine	-Treats moderate to severe pain. - Is sometimes given before or after a surgery. -May also be given with a general anaesthesia before an operation. -Belongs to a class of drugs called narcotic analgesics.	-It should not be taken on empty stomach. -It should not be used with alcohol. -Overdosage should be avoided. -Patient should be monitor for possible side effect.	Dizziness;drowsiness; exaggerated sense of well-being light-headedness; nausea; redness, swelling, or irritation at injection site; vomiting. -High dose may cause high blood pressure or high heart rate. -It may also increase cardiac work after myocardial infarction when given intravenously and hence this

			<p>use should be avoided where possible.</p> <p>-Likewise rarely it has been associated with agranulocytosis, erythema multiforme and toxic epidermal necrolysis</p>
Intravenous Cefuroxime	<p>-It acts against Haemophilus influenzae, Neisseria gonorrhoeae, and Lyme disease.</p> <p>-Unlike most other second-generation cephalosporins, cefuroxime can cross the blood-brain barrier.</p>	<p>-Avoid overdose.</p> <p>- If ingested after food, this antibiotic is both better absorbed, so do not administer in an empty stomach.</p>	<p>-Cefuroxime is generally well-tolerated and its side effects are usually transient.</p> <p>- most common side effects of diarrhea, nausea, vomiting, headaches/migraines, dizziness, and abdominal pain</p>
Syrup Cataflam	<p>Cataflam is a nonsteroidal anti-inflammatory drug (NSAID) taken or applied to reduce inflammation and as an analgesic reducing pain in certain conditions</p>	<p>Liver function should be monitored regularly during long-term treatment.</p> <p>-Avoid over dosage.</p> <p>-Do not administer to patient with history of ulcer.</p> <p>-Do not administer in an empty stomach.</p> <p>-Transaminases should be monitored within 4 to 8 week after initiating treatment with diclofenac.</p>	<p>-Can lead to stomach ulcer</p> <p>-Liver damage occurs infrequently, and is usually reversible.</p> <p>- Patients with osteoarthritis more often develop symptomatic liver disease than patients with rheumatoid arthritis.</p>
Syrup Paracetamol	<p>-It is to treat many conditions such as backache, toothache, headache, muscle pain and fever.</p> <p>-It alters the response of heat nregulating centre in the hypothalamus and raised the pain threshold.</p>	<p>-Do not administer without food.</p> <p>-Avoid overdosage.</p> <p>-Monitor patient closely for possible side effect.</p>	<p>-common side effect are abdominal pain, nausea, vomiting, sweating,</p> <p>-Paracetamol hepatotoxicity can occur as a result of over dosage and most especially along side with alcohol intakes.-</p> <p>-</p>

DRUG	ACTION	NURSING IMPLICATION	ADVERSE EFFECT
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Intravenous Cefuroxime	-It acts against Haemophilus influenzae, Neisseria gonorrhoeae, and Lyme disease. -Unlike most other second-generation cephalosporins, cefuroxime can cross the blood-brain barrier.	-Avoid overdose. - If ingested after food, this antibiotic is both better absorbed, so do not administer in an empty stomach.	-Cefuroxime is generally well-tolerated and its side effects are usually transient. - most common side effects of diarrhea, nausea, vomiting, headaches/migraines, dizziness, and abdominal pain
Syrup Cataflam	Cataflam is a nonsteroidal anti-inflammatory drug (NSAID) taken or applied to reduce inflammation and as an analgesic reducing pain in certain conditions	Liver function should be monitored regularly during long-term treatment. -Avoid over dosage. -Do not administer to patient with history of ulcer. -Do not administer in an empty stomach. -Transaminases should be monitored within 4 to 8 week after initiating treatment with diclofenac.	-Can lead to stomach ulcer -Liver damage occurs infrequently, and is usually reversible. - Patients with osteoarthritis more often develop symptomatic liver disease than patients with rheumatoid arthritis.
Syrup Paracetamol	-It is to treat many conditions such as backache, toothache, headache, muscle pain	-Do not administer without food. -Avoid overdosage. -Monitor patient	-common side effect are abdominal pain, nausea, vomiting, sweating, -Paracetamol hepatotoxicity

	and fever. -It alters the response of heat nregulating centre in the hypothalamus and raised the pain threshold.	closely for possible side effect.	can occur as a result of over dosage and most especially along side with alcohol intakes.- -
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Source: Patient's case note number 1278540 August, 2015; Joint Formulary Committee (2013). *British National Formulary (BNF)* (65 ed.). London, UK: Pharmaceutical Press. ISBN 978-0-85711-084-8

Special procedure

These were in three categories:

- The patient- physical care was ensured throughout hospitalization. The mother was given psychological support; his family members and Imam were allowed to visit and prayed for Master A.A.
- The affected upper limb- daily observation of the affected limb was done to prevent further injury. Active and passive exercise was encouraged.
- The Cast- checking for proper anatomical alignment was done. The skin area around the cast was clean and dry. Day –to-day care of the patient was also ensured.

Nursing care plan for Master A. A

WARD/UNIT: Ward 1

Date & Time	S/N	Nursing Diagnosis/Problem	Objectives	Nursing Orders	Scientific Principles	Evaluation
27/7/15	1.	Acute pain related to movement of bone fragments, oedema and injury to the soft tissue evidenced by reports of cry and pain	-Patient will display relaxed manner and stop crying within 30 minutes of intervention. -Patient will be able to sleep and rest appropriately.	-Maintain immobilization of the affected part by means of bed rest, cast. -Support the injured humerus. - Avoid the use of plastic sheets and pillows under limbs in cast. -Evaluate and document reports of pain or discomfort. Note characteristics including intensity (0-10 scale), relieving and aggravating factors. - Note non verbal pain cues (changes in vital signs, emotions and behaviour). -Administer syrup Ibufen 3.5 mls & I/V Pentazocine 7.5 mg b.d as prescribed.	-Relieves pain, prevents bone displacement and extension of tissue injury. -Promotes venous return, decreases oedema and can reduce pain. -It can increase discomfort by enhancing heat production in the drying cast. -Influences effectiveness of interventions. -Absence of pain expression does not necessarily mean lack of pain. Given to relief pain by blocking the pain pathway.	-Patient displayed relaxed manner -Patient was able to sleep well and pain was relieved. -Patient's level of pain was maintained at scale of 4
28/7/5	2.	Impaired physical mobility related to reduced motion, that is, reduced flexion of the right arm evidenced by motion below 45°C and restricted therapy (limb immobilization and mobility to use the hand). Disturbed sleep pattern related to	-Patient will regain and maintain mobility within 2 weeks of intervention. Patient will enjoy adequate sleep for at least 6 hours at	-Assess degrees of immobility and note patient's perception of immobility. -Check the plaster cast and ensure it is not too tight -Check the extremities	-Patient may be restricted by self view or actual physical limitations. -To avoid oedema of the fingers and possible pain. -Comfort will make patient to relax and induce sleep.	Patient still on cast but could move fingers gradually. -Patient's fingers were not oedematous Patient enjoyed adequate sleep. -Patient did not

	<p>pain as evidenced by interrupted sleep. Risk for disuse syndrome related to pathological fracture. Risk for impaired skin integrity related to application of cast.</p>	<p>night. -Patient will adapt to the use of the right hand till the cast is removed. -Patient will maintain intact skin throughout the period of hospitalization.</p>	<p>for adequate blood flow. -Teach patient how to exercise fingers. -Make patient comfortable on bed. -Maintain a therapeutic environment. -Plan nursing activities without disturbing the patient's sleep. - Give warm bath before bedtime. -Teach patient how to use the right hand (that is, the affected hand gradually). -Inspect the skin regularly and report any abnormal change -Ensure the cast is not tight on the affected upper limb. -Give patient well balanced diet including protein, roughage and fluid. -Encourage high personal hygiene.</p>	<p>Therapeutic environment relaxes patient and may induce sleep. -Adequate planning of nursing activities will prevent undue disturbance of the patient. -Teaching patient how to use the affected hand will not lead to disuse syndrome. Teaching patient how to use the right hand (that is, the affected hand gradually) will prevent disuse syndrome and will help in regaining the function gradually. To avoid break in the continuity of skin. Tight cast will prevent adequate circulation of blood to the surrounding areas and can prevent body's natural process of repair. -This provides a positive nitrogen balance to aid in bone healing and to maintain general good health. This prevents nosocomial infection.</p>	<p>experience any form of disturbance. -Patient did not develop any disuse syndrome throughout the period of hospitalization. Patient did not suffer any disuse syndrome throughout the period of hospitalization. Patient's skin was intact and its integrity maintained throughout the period of hospitalization.</p>
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Day- to- day care of the client

29/7/2015-31/7/2015

Patient was made comfortable on bed, vital signs were checked and read. Temperature, 37°C, pulse 126b/m, Respiration 44c/m, Blood pressure not assessed. He had intravenous Pentazocine 7.5mg, Syrup Cataflam 3.5mls, and Paracetamol 7.5mls. The upper limb on cast was well positioned and his mother was reassured.

1/8/2015

Nursing care was given, bed making was done, patient's environment was cleaned and tidy, and made comfortable on bed, vital sign; temperature was 36.9°C, pulse 122b/m, Respiration 42c/m, Blood pressure 80/60mmHg. He had his routine medication; Syrup Cataflam 3.5mls and Paracetamol 7.5mls with good effects. He was fed with protein diet (beans) that was served by the hospital staffers from the kitchen. Mother was encouraged to purchase some oranges for him which she gladly did. Patient also drank about 70mls of water. Active and passive exercise encouraged.

2/8/2015-4/8/2015

He was bathed and dressed, his bed was made and his environment well kept. Vital signs were checked; temperature read 36.5°C, pulse 120b/m, respiration 40c/m, Blood pressure not assessed. Due drugs Syrup Cataflam 3.5mls and Paracetamol 7.5mls were administered and documented. His cast was dried maintained in proper alignment and patient's mother was educated on the need to maintain the cast in proper alignment and should avoid undue movement.

5/8/2015

Patient remained calm and stable on bed and still on his routine analgesic syrup. Active and passive exercise was encouraged, assisted nursing care were rendered. Vital signs were checked and documented as follows: temperature 36°C, pulse 116b/m, respiration 44c/m, blood pressure not assessed. Post skeletal check X-ray not yet done due to some logistic reason and financial problem, patient's mother was reassured and was advised to meet with social worker in the hospital to discuss her financial status and other problems.

6/8/2015-15/8/2015

Patient condition remained stable and still on his routine analgesic syrup which was given. Active and passive exercise was encouraged, assisted nursing care were rendered. Vital signs were checked and documented as follows: temperature 36°C, pulse 116b/m, respiration 44c/m, blood pressure 80/60mmHg. Post skeletal check X-ray was done patient's mother was reassured. The medical team reviewed him and eventually discharged him on the 18th August, 2015 to Physiotherapy unit for exercise of the limb. As public health nurse, patient mother's phone number was collected for contact and home visit was made in three consecutive time before termination.

Health education of the patient on discharge

- Mother was educated on the importance of balanced diet rich in protein and vitamins to aid bone healing.
- To continue personal hygiene
- To keep physiotherapy appointment and schedule
- Encouraged to continue active and passive exercise for her son.
- Early use of the affected upper limb as soon as re-check of post skeletal check X-ray confirms healing.
- Mother was encouraged to attend sickle cell clinic for proper monitoring of the child.

Conclusion

Based on our involvement in the care of Master A. A, we observed that his SCD condition made him to experience crisis and role limitation due to physical problems as evidenced by his previous diagnosis (dactylitis) which led to hospitalization for weeks after which he was later readmitted on account of Osteomyelitis and pathological fracture. Mother was also noticed to be psychologically down due to stress, prolong period of hospitalization, financial constraint and fear of unknown concerning prognosis.

Implication of the care study for community/public health

There is psychological complication in both children and adults with SCD including appropriate pain coping strategies, reduced quality of life owing to restrictions in daily functioning, anxiety and depression including neuro-cognitive impairment. It therefore means that, the individual family and community need precise and concise genetic counselling education on how to prevent SCD. Since psychological complication in patient with SCD mainly result from pain and symptoms on their daily lives and society's attitude towards them, it therefore means that, community/public health practitioners should engage patients with SCD and their carer on special educational support programme that will focus on improving their quality of life.

Recommendations

The following recommendations are made based on the context of our involvement in the care of Master A. A

- There is need for continuous genetic counselling prior to marriage to avoid HbAS marrying themselves. This could be achieved through community mobilization and diagnosis
- Philanthropists should assist in helping patients with SCD to pay hospital bills which will in turn help to alleviate their suffering.
- There is need for psychological intervention therapy for parent of SCD patient.
- To improve prognostic index, SCD patients and their carer must have good understanding of the disease process for positive outcome.

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