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Pathological Fracture of Lower Limb in Children

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ABSTRACT

Background: pathological fractures in children occur from many aetiology. The physician has to develop an individual strategy for management and rehabilitation, considering the biology of bone and the biomechanics at the fracture site to detect pathology of lesion and to reach perfect bone healing. Time-efficient protection and reconstruction of the child's musculoskeletal system is the aim of the orthopaedic surgeon's intervention. The whole strategy must be individualized to every situation.

Objective: The goals of managing a child's pathological fracture are all based on establishing a diagnosis. Fracture management is then based on five points: (a) relief the pain; (b) achieve local control of the pathological lesion; (c) skeletal stabilization, preservation of growth, and maintain anatomical alignment; (d) fracture healing; and (e) restoration of function.

Patients and Methods: Our study was done over 20 cases of pathological fracture of lower limb in children in Al-Azhar University Hospitals (Al-Hossin and Saeid Galal hospitals) from January 2016 to December 2018. Imaging and radiology reports were used to determine fracture types. Complete fractures were classified to four major types: transverse, spiral, oblique and comminuted. In our study we use the Musculoskeletal Tumor Society (MSTS) scoring system to assess functional outcome for each patient. For lower extremity function, the MSTS used a 0-5 scale for the following variables: motion, pain, stability, deformity, strength, functional activity and emotional acceptance.

Results: According to our study no patients with fractures underwent amputation, affection of neurovascular structures, or tumour progression on therapy. Pathologic fracture was not an indication for any of the amputation procedures, only the tumour pathology in an indication. Two patients refused surgery. Only one patient had a local recurrence after limb salvage surgery, and underwent no further surgical intervention.

Keywords: Pathological Fracture, Lower Limb, osteogenesis imperfecta, MSTS, Non-ossifying fibroma, Unicameral bone cyst, Aneurysmal bone cyst, simple bone cyst, tumour.

INTRODUCTION

A pathological fracture is defined as fracture that occurs through abnormal bone. These fractures occur in bone deficit in normal biomechanical and viscoelastic properties. Pathological fractures may result from intrinsic or extrinsic causes. Examples of intrinsic processes include the osteopenia of osteogenesis imperfecta or replacement of bone by tumour [(1)].

With extrinsic processes, the weakness is caused by something that lessens the inherent structural integrity of bone, such as radiation or a hole in bone from biopsy or internal fixation. In addition, pathological fractures may result from localized (eg, a bone cyst) or systemic processes (such as osteopetrosis), and the fracture may heal with treatment of the underlying condition (rickets), or not (metastatic cancer). Pathological fractures can occur in children with generalized bone conditions and in those with tumors or tumor-like processes of bone [(1)].

Although child with generalized bone disease (osteogenesis imperfecta, osteopetrosis, steroids, and rickets) may be a fracture, more commonly, the diagnosis has been made by clinical findings such as history, physical examination, x-rays, laboratory findings, or biopsy. Evaluation of the child with fractures is the goal, as no clear guidelines exist to distinguish traumatic from pathological fractures[(4-5)].

For evaluation and treatment of children with fractures and low bone mineral density (BMD), the diagnosis of osteoporosis in a paediatric patient should be made using a combination of clinical and radiographic features.

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Conservative measures including calcium and vitamin D supplementation and weight-bearing physical activity are important interventions. The management of pathological fractures in children remains controversial. The indications for surgical treatment are unclear and the need for histological study before or after definitive treatment[2,3,5,7].According to paper reviewed retrospectively the records of all patients under the age of 16 years old who presented over the past 3 years with a fracture as the first manifestation of bone pathology. The best recommend management is primary fixation of pathological fractures should be avoided until histological diagnosis is done. Most lesions should underwent biopsy study. However, if radiographic appearances show benign, biopsy can be delayed until conservative fracture management is completed. Definitive treatment of benign lesions with protective intra medullary nailing or curettage and grafting can follow frozen section under the same anesthetics [3].

AIM OF THE WORK

To study causes, investigation and treatment of 20 cases of pathological fractures in lower limb of children. To decide the treatment if; Conservative treatment, or Operative treatment.

MATERIALS AND METHODS

Our study was done over 20 cases of pathological fracture of lower limb in children in Alazhar University Hospitals (Al-Hossin and Saeid Galal hospitals) from January 2016 to December 2018.

Imaging and radiology reports were used to determine fracture types. Complete fractures were classified to four major types: transverse, spiral, oblique and comminuted[4-5].

Including criteria: Children from 1year old to 16 years old. Children with fractures on top of bone disease or bone tumour. Children with pathological fracture in lower limb.

Exclusion criteria: Adolescent, adult and old age. Children with fracture on normal bone. Children with fractures in upper limb. Children with pathological disease or tumor without fracture.

In our study we use the Musculoskeletal Tumour Society (MSTS) scoring system to assess functional outcome for each patient. For lower extremity function, the MSTS used a 0-5 scale for the following variables: motion, pain, stability, deformity, strength, functional activity and emotional acceptance[6].

The MSTS is a measure of physical function across 7 items, completed by Orthopaedic Surgeon staff. The 7 items are: pain, range of motion, strength, joint stability, joint deformity, emotional acceptance, and overall function. Each item is scored from 0-5 with a maximum possible score of 35[10,11].

RESULTS

Table (1): Description of age of studied patients.

Variable		Studied patients N = (20)
Age (years)	Mean	10
	±SD	3.7
	Min	4
	Max	15

This table shows the description of age of studied patients. The mean age of studied patients was 10 ± 3.7 years with minimum age of 4 years and maximum age of 15 years.

Table (2): Description of gender of studied patients.

Variable		Studied patients N = (20)
Gender	Male	14 (70%)
	Female	6 (30%)

This table shows the description of gender of studied patients. 14 patients (70%) were males while 6 patients (30%) were females.

Table (3): Description of lesion histopathology of studied patients.

Variable		Studied patients N = (20)
Histopathology of the lesion	Simple bone cyst	4 (20%)
	Anuresmal bone cyst	6 (30%)
	Non ossifying fibroma	3 (15%)
	Fibrous dysplasia	4 (20%)
	Osteogenesis imperfecta	2 (10%)
	Osteosarcoma	1 (5%)

This table shows the description of lesion histopathology of studied patients. 4 patients (20%) showed Simple bone cyst, 6 patients (30%) showed Anuresmal bone cyst, 3 patients (15%) showed non-ossifying fibroma, 4 patients (20%) showed Fibrous dysplasia, 2 patients (10%)

showed Osteogenesis imperfecta and 1 patient (5%) showed Osteosarcoma.

Table (4): Description of method of fixation of studied patients.

Variable		Studied patients N = (20)
Method of fixation	**Casting**	2 (10%)
	k-wires and casting	2 (10%)
	Nansy nail	4 (20%)
	Small DCP	4 (20%)
	locking plate	4 (20%)
	T patrus plate	2 (10%)
	T volar plate	2 (10%)

This table shows the description of method of fixation of studied patients. 2 patients (10%) were done by casting, 2 patients (10%) were done by k-wires and casting, 4 patients (20%) were done by Nansy nail, 4 patients (20%) were done by Small DCP, 4 patients (20%) were done by locking plate, 2 patients (10%) were done by T patrus plate and 2 patients (10%) were done by T volar plate.

Table (5): Description of motion of studied patients.

Variable		Studied patients N = (20)
Motion	**sever limitation**	1 (5%)
	moderate limitation	3 (15%)
	mild limitation	2 (10%)
	no limitation	14 (70%)

This table shows the description of motion of studied patients. 1 patient (5%) showed sever limitation, 3 patients (15%) showed moderate limitation, 2 patients (10%) showed mild limitation and 14 patients (70%) showed no limitation.

Table (6): Description of pain of studied patients.

Variable		Studied patients N = (20)
Pain	**Moderate**	1 (5%)
	Mild	8 (40%)
	None	11 (55%)

This table shows the description of pain of studied patients. 1 patient (5%) showed moderate pain, 8 patients (40%) showed mild pain and 11 patients (55%) showed no pain.

Table (7): Description of stability of studied patients.

Variable		Studied patients N = (20)
Stability	**moderate deformity or trendelenburg + cane**	1 (5%)
	mild deformity or trendelenburg gait	4 (20%)
	no deformity or abnormal gait	15 (75%)

This table shows the description of stability of studied patients. 1 patient (5%) showed moderate deformity or trendelenburg + cane, 4 patients (20%) showed mild deformity or trendelenburg gait and 15 patients (75%) showed no deformity or abnormal gait.

Table (8): Description of deformity of studied patients.

Variable		Studied patients N = (20)
Deformity	**Moderate**	2 (10%)
	Mild	2 (10%)
	No	16 (80%)

This table shows the description of deformity of studied patients. 2 patients (10%) showed moderate deformity, 2 patients (10%) showed mild deformity and 16 patients (80%) showed no deformity.

Table (9): Description of strength of studied patients.

Variable		Studied patients N = (20)
Striength	**overcome gravity**	1 (5%)
	less than normal resistance	3 (15%)
	normal resistance	16 (80%)

This table shows the description of strength of studied patients. 1 patient (5%) could overcome gravity, 3 patients (15%) showed less than normal resistance and 16 patients (80%) showed normal resistance.

Table (10): Description of functional activity of studied patients.

Variable		Studied patients N = (20)
functional activity	**partial disability**	4 (20%)
	no restriction	16 (80%)

This table shows the description of functional activity of studied patients. 4 patient

(20%) showed partial disability and 16 patients (80%) showed no restriction.

Table (11): Description of Emotional acceptance of studied patients.

Variable		Studied patients N = (20)
Emotional acceptance	Dislikes	2 (10%)
	Accepts	2 (10%)
	Enthusiastic	16 (80%)

This table shows the description of Emotional acceptance of studied patients. 2 patients (10%) disliked, 2 patients (10%) accepted and 16 patients (80%) were Enthusiastic.

Table (12): Description of MSTS scoring of studied patients.

Variable		Studied patients N = (20)
MSTS scoring	Mean	29.6
	±SD	9.4
	Min	5
	Max	35

This table shows the description of MSTS scoring of studied patients. The mean MSTS scoring of studied patients was 29.6 ± 9.4 with minimum MSTS scoring of 5 and maximum MSTS scoring of 35.

DISCUSSION

Pathologic fractures occur in child patients spontaneously or due to minor trauma[6]. In our study, the majority of patients (95%) presented by pathologic fracture on top of primary disease.

To date, A few data has been reported on the types of fractures in these patients[4]. We found that type of fracture was highly variable as was fracture healing; 90% of our patients showed evidence of fracture healing. In contrast, Ferguson et al[11] reported 30% of fracture healing in their patients. It has been suggested that chemotherapy may promote healing of these fractures prior to surgery. Fracture healing has also been associated with better prognosis. It increases union and decreased local recurrence.

The management of pathologic fractures in children has been addressed by several authors [5,7,10-13].

***Jackson et al.*[5]** proposed that any type of management should be done after a biopsy and histological diagnosis are obtained.

Saraph and Linhart[12] proposed that management of pathologic fractures should take into consideration the pain and comfort of the child, local control of the lesion, stabilization and anatomical alignment of the fracture, fracture union, and functional restoration.

***Ruggieri et al.*[13]** proposed that fractures should be initially managed by cast or external fixation to avoid microscopic spread of the tumor.

The management of pathologic fractures in our study was highly deferent. The majority of patients underwent curettage of the lesion then open reduction internal fixation with variant implant.

Two prominent studies stated pathologic fracture was significantly associated with an increased local recurrence rate[7]. However, multiple recent studies have contradicted their results[8,9]. Our results support these more recent studies. We found that the local recurrence rate among pathologic fracture patients was lower than those without fracture. This could be due to improper curettage and in adequate resect of wide margins in pathologic fracture patients.

Local recurrence rates in pathologic fracture patients range from 10-26% in different studies [4].

Prolonged immobilization for management of fracture may lead to more muscle atrophy which could lead to bad functional outcomes. Further, a wider surgical resection could lead to decreased functional outcome after surgery. This significant difference in functional outcomes could be important knowledge for physical therapists and surgeons planning postoperative rehabilitation programs[11].

***Scully et al.* [10]**; ***Ferguson et al.* [11]** all have reported a decrease in overall survival in pathologic fracture patients.

On the basis of our results, we find that pathologic fractures of lower limb in children patients are differed. Fracture management was highly variable and should be investigated further. The presence of a pathologic fracture did not increase risk of local recurrence or distant metastases [11].

CONCLUSION

Pathological fractures in children occur from many etiology. The orthopaedic surgeon has to develop an individual strategy that promotes treatment, considering bone biology and biomechanics of fracture site. Define of the lesion pathology is important, whether it is in the form of a neoplastic or non-neoplastic organ, so promote bone healing. Time-efficient protection and reconstruction of the child's musculoskeletal system is the aim of the orthopaedic surgeon's intervention. The whole strategy must be specified to every case. Combinations of diseases, fracture sites, and children are many, so treatment options are fewer. Options include non-operative management with observation, and intralesional resection with or without bone grafting, and with or without internal fixation.

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