

# The Utilization of Orthopedic Fixators as a Means of Management of Pathologic Fractures in Young Adults and Adolescents: A Short Review

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## Abstract

Fixators are internal or external rigid equipment that acts as stabilizing frames to hold broken bones in their proper anatomical positions while they heal. The application of a fixator is a complex procedure that is done in the operating theatre by orthopaedic and trauma surgeons. Fixators may be temporary or permanent, however, they are often indicated in fractures. Fractures may simply be understood as a partial or complete break in the continuity of bones. They may be caused by trauma, fractures due to overuse, infections and diseases that weaken the bones. The latter is most common in children and physiologically in some women who have attained menopause. This paper however shades more lamplight on the use of fixators in the treatment of fractures that are non-traumatic in young adults. These fractures have a rather pathologic course in their aetiology.

**Keywords:** Pathologic Fractures; Internal; External; Fixators; young adults; adolescents; orthopaedics; bone cancer

## Introduction

A practical definition of a fixator is a special (often rigid) device used in orthopaedics surgeries for the treatment of fractures, soft tissues and reconstructive surgeries. They are commonly employed after the appropriate reduction of the fracture. They may be employed internally, externally or in the intramedullary region (Slone RM et al). Irrespective of the type of fixator used, the aim is bone healing and stabilization, with reliance on homeostatic and callus formation to promote osteosynthesis in the region of the fracture. Nonetheless, some fixators are specially formulated to aid healing in certain bones and joints, such as some specialised locking plate internal fixators with appropriate contours to account for articular surfaces, thus providing adequate biomechanical support (Schmal H et al). The common complications that may arise with the use of fixators are bleeding, infection, osteomyelitis, fixator failure, mal-union, non-union and refracture, amongst others (Hadeed A et al).

While internal fixators are relatively new, external fixators have been used for over 2000- years. Although there has been some advancement in the equipment and skill, the basic principles have remained relatively the same (Hadeed A et al). The internal fixators require open surgeries that may utilise wires, plates and screws, or intramedullary rods, amongst others. They have the advantages of shorter hospital stays, shorter recovery time, and fewer side effects of non-union and mal-union. However, they are rarer, require more specialist skill, need the patient to be more haemodynamically stable for open surgeries and are more expensive in comparison to external fixators (Lowe JA et al) (Schmal H et al). That said, it is worthy of note that not all fractures require fixators.

An objective way to look at fractures is simply a break in the continuity of bones. This may be caused by a variety of events. However pathologic fractures occur in abnormal or diseased bones. This disease may be localised or generalised, such as cysts, malignancy, rickets, osteoporosis, and so on. A common denominator is the minimal to rather trivial force needed to produce this fracture (Archampong E et al). Furthermore, some studies have lone classified pathologic fractures as those involving a benign or metastatic bone lesion only. Such studies subclassified non-traumatic fractures into pathologic fractures, stress fractures and insufficiency fractures (Wuennemann F et al). Denoting pathologic fractures as those that are with neoplastic properties, only. While this may be valid as a more specialist-oriented or radiological classification, this paper will not be discussed based on these sub-sections.

## Discussion

The management of pathologic fractures is a multidisciplinary task.

The common pathologies implicated in pathologic fractures vary from region to region. A study carried out in India cited osteoporosis as one of the common causes in children and adolescents. It went further to discuss immobilization from acute and chronic diseases, such as Duchenne's Muscular Dystrophy (DMD) as some of the causes of secondary osteoporosis. It also mentioned steroid drug use as a negative impact drug that may lead to osteoporosis (Ciancia S et al). While other papers support this, the impact of steroids on bone health is beyond the scope of this paper (Bell et al). In these cases of acquired osteoporosis, treatment targeted towards the causative agent is the goal of management, while focusing on bone mass improvement. This can be managed by paediatric physicians or paediatric bone specialists (Bell et al).

Moreover, osteoporosis has been seen to be a common pathophysiology in postmenopausal women presenting with fractures to the orthopaedics clinic. Treatment trials ranging from Vitamin D supplementation to Hormonal supplementation have been tested. Vitamin D alone at clinical doses are insufficient to produce any significant results in terms of prevention (Avenell A et al). While the long use of hormonal replacement therapies has long been linked with neoplastic risks. Hence, we will still expect to see women presenting with fractures from demineralised and thinning long bones to our clinics that may not be strong enough to hold fixator screws and/or pins. There are not many papers on the surgical management of postmenopausal osteoporosis. The management goal is targeted at prevention, conservative care and increasing bone mass and strength.

Oncologically speaking, it is worth of note that the skeleton is the most common organ to be affected by metastatic cancers and is the one that produces the most morbidity. While the morbidity may vary from months -as in lung cancers- to years -as in Prostate and

Breast cancers- (Coleman et al). There may be some markers routinely monitored to know when bone encryption has begun (Berutti A et al). Notwithstanding, the bones may also be the primary cancer site in some cases (Coleman R et al). Whatever the history, once the bone is harbouring a malignant tumour, surgical management is an option. Patients who have had surgical management in cases of primary or secondary bone malignancy were found to have better function scores. Studies have explored the role of resection and use of bone cement to fill up bone gaps, while others that have also reported better outcomes and quicker rehabilitation have explored the roles of resection, use of Polymethyl Methacrylate (PMMA) and utilization of internal fixators especially in the management of long bones. Surgical management involving the use of plates and Intramedullary nails has been cited routinely (Zore Z et al). However, in situations where the bone segment retained after resection is too little, arthroplasty and replacements are common surgical alternatives (Zore Z et al, Scolaro J et al).

Furthermore, there are some benign bone lesions too that are of clinical orthopaedic importance, as they are also implicated in causes of pathologic fractures, especially in children. Bone cysts, aneurysmal bone cysts and fibrous dysplasia are noted causes of pathologic fractures in children. Clinical trials have shown a remarkable improvement in the management with use of internal fixators, as compared to conservative management (Lin A et al). Another study described more comprehensive surgical approaches similar to that described above in the surgical management of malignant bone lesions, involving the resection, filling and application of internal fixators as more positively prognostic than other modalities (Tomaszewski R et al). But when we consider these surgeries in children, it thus begs the question of the possibility of limb shortening.

While we have extensively discussed the use of internal fixators in the surgical interventions of benign and malignant bone tumours, it is worth of note that though external fixators are not commonly used in this intervention, some studies have started exploring their role in this regard. A paper published by Matsubara and Tyuchira in 2019 extensively studied the role of external fixators in the management of benign and malignant bone tumours via distraction osteogenesis, and they concluded that it was an efficient means of management (Matsubara H et al). They went further to explain that the use of external fixators offers some advantages such as complex deformity correction without the need for tumour resection or reconstruction when dealing with benign tumours and regeneration of durable and strong living bones when dealing with malignant tumours. However, the disadvantages foresaw were the possibility of non-union of bones, the time-consuming surgical process and the possibility of tract infections (Matsubara H et al).

This discussion will not be complete without speaking about the trojan horse of pathologic bone fractures, osteomyelitis. Though the acute form is rare in adults, except in immunocompromability, but commonly seen as a disease of growing bone in children; the chronic form is more readily seen in orthopaedic clinics. The base line however is the bacterial infection of the bones. While it may be as a result of hematologic spread or following a trauma, it may also be a primary chronic infection of the bone. Commonly, it has a gram-positive bacteria-based aetiology, but in rare cases, the inoculate can be spirochetes, fungi, M tuberculae or Brucella (Mclatchie G et al). Although the foundation of its management is intravenous antibiotics, surgical management involves the introduction of drains, debridement, resection, reduction and in some cases, the use of fixators.

## Conclusion

Pathologic fractures by the nature of their pathology require a multidisciplinary team in her management. It may be the Oncologist, Nutritionist, Internist, Paediatrician, Bone specialist, Physiotherapist and even the Psychologist. The goal of her management is primarily the management of the pathology causing the fracture. Surgical attending to the fracture is secondary.

The role of fixators in the repair of pathologic fractures is indispensable. Fixators (external or internal) provide the needed rigidity for osteosynthesis and the union of a properly reduced bone. The choice between internal or external fixators is influenced by surgical skills, personnel, extent/nature of pathology, cost, availability and patients' consent. Common causes of pathologic fractures in paediatrics may not require surgical interventions. As many paediatricians and paediatric bone specialists are trained enough to handle this.

Hence, the role of fixators in pathologic fractures is not absolute. They are only involved when a bone union is desired following bone death, malignancy or surgical resection. Or when a certain level of bone rigidity is desired for osteosynthesis, and bone mass growth

and strengthening is desired. However, at the top of the criteria for its use is specialist skill availability. Then others may follow.

## Conflict of Interest

The Author declares no conflict of interest.

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