
Preface

The subspecialty of Pediatric Orthopedics is distinguished from adult orthopedics in many ways. The most prominent difference is the presence of growth plates (physes). Once the growth plates close the patient physically becomes an adult. Growth disturbance of long bones is a common major clinical issue for pediatric orthopedics. Physes of epiphyses are the sole providers of longitudinal bone growth. Since physes of apophyses provide no longitudinal growth, apophyseal injuries are not included in this text.

Physes may be injured in many ways, the most common of which is fracture. This textbook is an overview of injuries to the epiphyseal growth plate *other than* fracture. Most non-fracture injuries of epiphyseal physes sufficient to cause diminution of growth have two similar characteristics: roentgenographically normal physes at the time of injury and physeal abnormality noted weeks, months, or years later. Injuries which meet these criteria are described in the following chapters:

1. Vascular
2. Disuse
3. Infection
4. Tumor
5. Metabolic
6. Neural
7. Cold (frostbite)
8. Heat (burn)
9. Electrical
10. Compression
11. Distraction
12. Stress
13. Irradiation
14. Light Waves
15. Sound Waves
16. Shock Waves
17. Atmospheric Pressure
18. Oxygen
19. Developmental
20. Surgical
21. Unknown

The number of patients sustaining growth arrest from each of these conditions is low. Even combined, their numbers do not equal physeal injuries due to fracture. However, in most of these conditions, premature growth arrest is the most common serious complication. In many, the precise pathogenesis of the physeal impairment is

obscure, speculative, or unknown. Grouping these conditions together may help to better understand them and hopefully help to prevent the harmful effects from occurring, or at least to anticipate them and thereby mitigate their harmful effects.

Many conditions resulting in physeal arrest could be appropriately recorded in one of several chapters. A prime example is poliomyelitis, an infection involving the nervous system. It could therefore be reported in Chap. 3, Infection, or Chap. 6, Neural. However, compelling evidence suggests that growth arrest in patients with poliomyelitis is due to disuse, and it is therefore reported in Chap. 2, Disuse. In most cases where a condition could be reported in more than one chapter, I have attempted to explain my reason for its location.

These injuries are extremely varied in nature. The basic insulting event may be located in a primary field of medicine far from pediatric orthopedics. Thus, although I have diligently searched the literature by computer and by reviewing reference lists in published articles, I doubt that the literature search is complete in any of the chapters. An attempt has been made to include all pertinent references in the English literature through December, 2007. Some articles in languages other than English are included, for example, a foreign language article with an English abstract which contains relevant information. In addition, some pertinent articles published after 2007 which came to my attention are included.

The rationale for the order of the chapters needs to be explained. Chapter 1 describes the vascular anatomy of the physis and vascular injuries resulting in growth arrest. Actually, many of the insults documented in subsequent chapters may primarily damage the vascularity to the physis, which thereby secondarily affects the physis, rather than damaging the physis directly. Chapters 2–13 describe injuries of the physis that are fairly well documented and accepted. Chapters 14–18 describe insults that occur due to advanced technology in modern life. Growth arrest from these insults are extremely rare and some have been found only in animals. However, since these modalities have damaged physes in animals, they could conceivably damage physes in humans. Developmental, Surgical, and Unknown causes are placed last.

Many of these injuries are iatrogenic; i.e., induced by the action of a physician. All of the conditions result in damage to selected or random physes. Conditions which affect the growth of all physis simultaneously, such as genetic disorders, skeletal dysplasias, cranial tumors which cause system wide endocrine abnormalities, etc., are not “injuries” in the sense discussed here and are not included.

Most children with physeal injuries other than fracture are treated and followed by physicians other than pediatric orthopedists. However, the management of the physeal abnormalities caused by these injuries is often similar to those caused by fracture, which is likewise greatly enhanced by their early detection. Pediatric orthopedists therefore need to be in close contact with all physicians who care for these patients. Early treatment of physeal arrest, including bar excision of affected physes in selected cases and surgical arrest of contralateral physes, should lessen the need for bone lengthening and shortening operations, arthrodesis, and amputation.

No other book or comprehensive source focuses on physeal injuries other than fracture. Several journal articles [1–8] and book chapters [9, 10] describe a few or several of these injuries, but none of these sources includes all of the conditions within this book.

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