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Structural or Positional Hallux Abductus?

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The podiatric surgeon must consider both the functional and cosmetic results of the hallux abductus surgical procedure he chooses. When the deformity is structural, there is congruity in the metatarsophalangeal joint, the articular surfaces are parallel and joint function is not disrupted; an osteotomy is performed to reduce the increased articular set angle(s). When hallux abductus is positional, the metatarsophalangeal joint does not display congruity and often motion is limited at the joint; capsular correction is used to reduce the subluxation or deviation of the first metatarsophalangeal joint.

When treating hallux abductus surgically, one is faced with the dilemma of choosing the procedure that would yield the best results both functionally and cosmetically. Too often, the podiatric surgeon falls into the "rut" of doing the "standard procedure." The purpose of this paper is to present some criteria for evaluating hallux abductus and surgical procedures utilized to correct the deformity on the basis of these criteria.

Hallux abductus literally means a transverse plane deviation of the hallux in relation to the first metatarsal in a direction away from the midline of the body. The nature of the deformity may be structural or positional.

Hallux abductus exists in the normal foot and is structural in nature. The long axis of the first metatarsal does not align with the long axis of the proximal phalanx. The intersection of the long axis of the first metatarsal and the proximal phalanx form the hallux abductus angle. It may deviate from 10 to 20 degrees, with an average of 15 degrees, without revealing any clinical deformity. The deviation occurs at the junction of the base and shaft of the proximal phalanx of the hallux and at the head of the first metatarsal. The articular surface of the base of the proximal phalanx of the hallux is angulated to its long axis as is the articular surface of the head of the first metatarsal. There is no perpendicular relationship between the articular surfaces and their long axes. The amount of deviation from a perpendicular relationship is known as the articular set angle. The articular set angle of the head of the first metatarsal varies from 5 to 8 degrees as does the articular set angle of the base of the proximal phalanx. The sum of the articular set angles accounts for a deviation of 10 to 20 degrees of hallux abductus in the normal foot (Fig. 1).

When the sum of the articular set angles of the head of the first metatarsal and the base of the proximal phalanx is greater than 15 degrees, the structural deviation of the hallux becomes clinically significant. The deformity may exist in the head of the first metatarsal (high proximal

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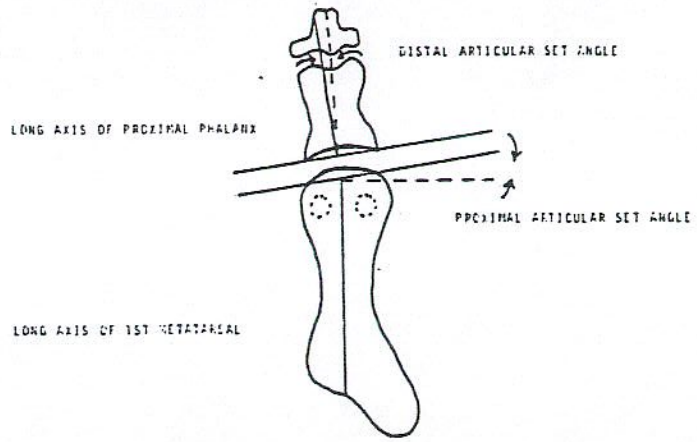

Figure 1. Normal amount of hallux abductus. Proximal articular set angle equals 5 to 8 degrees; distal articular set angle equals 5 to 8 degrees; and hallux abductus angle equals 10 to 20 degrees.

articular set angle), the base of the proximal phalanx (high distal articular set angle) or both (Fig. 2).

In the structural deformity we find congruity in the metatarsophalangeal joint. The articular surfaces are parallel and joint function is not disrupted.

When hallux abductus is positional in nature, the metatarsophalangeal joint does not display congruity. One frequently finds limitation of motion at the joint. The deformity, in fact, is a result of deviation or subluxation of the first metatarsophalangeal joint. We define a deviated joint as one in which lines representing the articular surfaces of the head of the first metatarsal and the base of the proximal phalanx are not parallel as they are in a congruous joint, but are divergent and cross outside the joint. When their lines cross inside the joint, the joint is said to be subluxed. The subluxed joint may be said to be the final progressive stage of a positional hallux abductus (Fig. 3).

Hallux abductus then can exist as a positional or structural deformity; it may also be a result of both a structural and a positional deformity. The sum of the articular set angles of the head of the first metatarsal and the base of the proximal phalanx may be greater than 20 degrees and the joint may be subluxed or deviated.

Usually in the development of hallux abductus, the deformity is first positional and then becomes structural when it is long-standing.

A great deal of hypermobility of the first ray causes the metatarsophalangeal joint to become subluxed or deviated. After functioning in this position for a prolonged period of time, the head of the first metatarsal undergoes "quiescent subluxation." The articular surface changes to adapt to the deviated position of the hallux (Fig. 4). There is erosion of the cartilage on the medial side of the head of the first metatarsal with production of

cartilage on the lateral side of the head. As a result, the angle formed by the articular cartilage of the head of the first metatarsal and its long axis is increased, if it is greater than 10 degrees, producing a high proximal articular set angle. The hallux now functions "smoothly" in this position and the joint has become congruous as a result of adaptive changes. It has now become a structural deformity.

Treatment

When attempting to treat hallux abductus surgically, it becomes important to determine the nature of the deformity in order to select the surgical approach that will yield the best functional result.

Hallux abductus, which is positional in nature, is best treated by "soft tissue procedures" such as Jones, Hiss or McBride. These procedures utilize

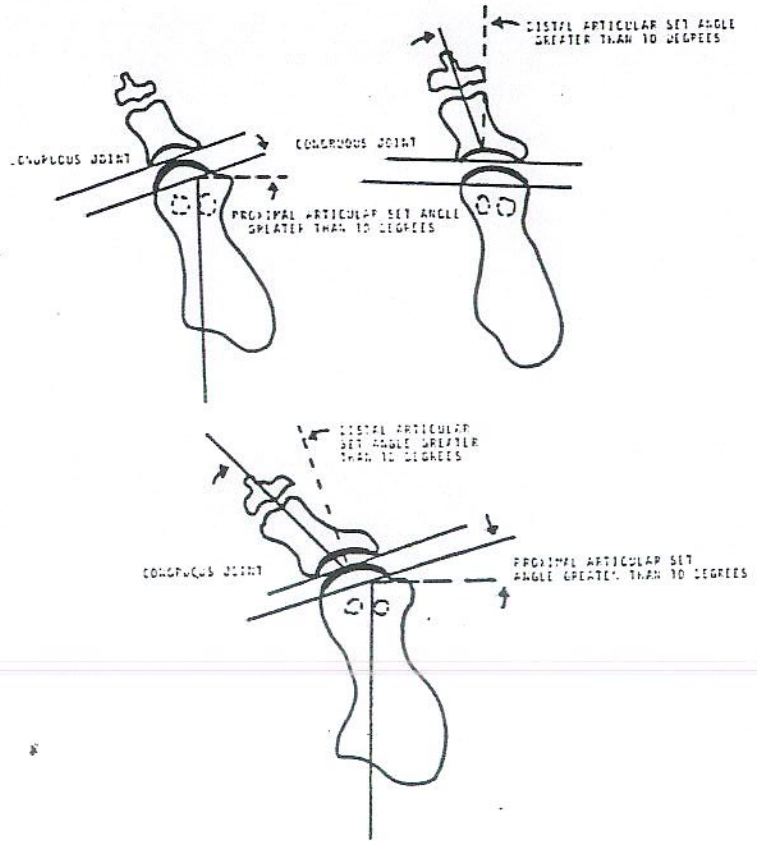

Figure 2. Structural hallux abductus.

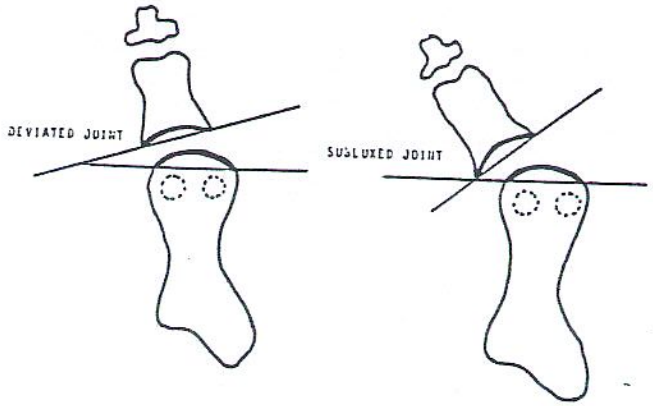

Figure 3. Positional hallux abductus. The hallux abductus angle is greater than 20 degrees due to subluxation or deviation at the metatarsophalangeal joint. The metatarsophalangeal joint is not congruous and motion is limited.

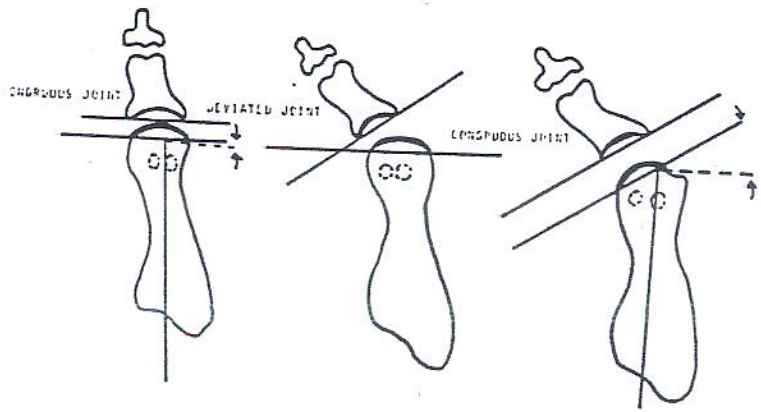

Figure 4. Development of structural hallux abductus. Congruous joint: the normal hallux abductus angle is 10 to 20 degrees (the proximal articular set angle is 5 to 8 degrees). Deviated joint: the hallux abductus angle is greater than 20 degrees due to positional deformity. Congruous joint: the hallux abductus angle is greater than 20 degrees due to acquired structural deformity (the proximal articular set angle is greater than 10 degrees).

various capsulorrhaphies to reduce the deviation or subluxation at the first metatarsophalangeal joint (Fig. 5). When the deformity is structural in nature, however, soft tissue procedures are not indicated. The metatarsophalangeal joint is congruous and soft tissue correction of the deformity will only deviate or sublux the joint and limit joint function (Fig. 6). Many

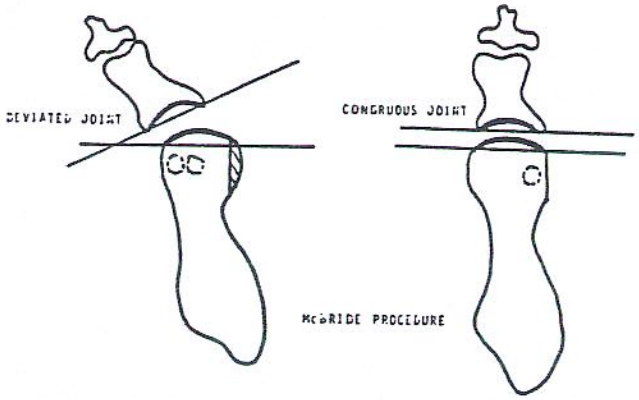

Figure 5. Correction of positional hallux abductus. Soft tissue procedure is utilized to reduce the deviation or subluxation at the metatarsophalangeal joint.

surgeons have been aware of this fact in attempting to treat hallux abductus. Giannestras noted "... the joint (1st metatarsophalangeal joint) has been functioning asymptomatically with only minimal limitation of motion in spite of its malposition for quite a number of years. Therefore, in my opinion, it is asking too much of such a joint to attempt to replace the proximal phalanx on a metatarsal where the medial one-third of the articular cartilage has become quite thin and eroded . . . ."

The awareness by many foot surgeons that the phalanx functions better in its abducted position, has led them to seek methods of correcting the deformity while maintaining the present metatarsophalangeal articulation. Repositioning the hallux to its original position by means of soft tissue correction and capsulorrhaphy yields a rectus attitude to the digit, but very often the toe functions poorly and there is a tendency toward recurrence of the deformity. In many instances, an arthroplasty of the joint must be resorted to in order to reduce the deformity.

Giannestras attempted to maintain the position of the hallux at the metatarsophalangeal joint and obtain a rectus position of the hallux by doing an adductory wedge osteotomy on the proximal phalanx (Akin procedure). " . . . why not leave the joint in its present position and simply correct the deformity of the great toe as well as remove the exostosis of the 1st metatarsal head" (Fig. 7). Giannestras utilized the Akin procedure for those deformities which were structural in nature and had a high proximal articular set angle. The joint was left in an abducted position while the hallux was adducted via osteotomy, thus achieving a rectus toe. We utilize the Akin procedure to correct those structural deformities where there is an exaggerated high distal articular set angle, i.e., where there is an angulation of more than 10 degrees between the long axis of the proximal phalanx and the base of the phalanx. With this procedure, the distal articular set angle is reduced.

When there is a high proximal articular set angle, we utilize the Peabody procedure. A closing adductory angulational wedge osteotomy is performed at the head of the first metatarsal, thus reducing the proximal articular set angle and repositioning the joint without changing the relationship between the hallux and the head of the first metatarsal (Fig. 8).

The Akin procedure is performed in the following manner: A linear incision, 5 cm. in length, is made on the medial aspect of the hallux, commencing at the metatarsophalangeal joint and terminating at the interphalangeal joint of the hallux. The incision is deepened, exposing the deeper structures and periosteum of the medial aspect of the base of the proximal phalanx. One-half cm. distal to the base of the proximal phalanx, an osteotomy is performed in a transverse fashion from medial to lateral. The lateral cortex is left intact. Approximately 5 mm. distal to the first osteotomy cut, a second osteotomy is performed, medial to lateral, converging with the first osteotomy cut at the lateral aspect of the bone.

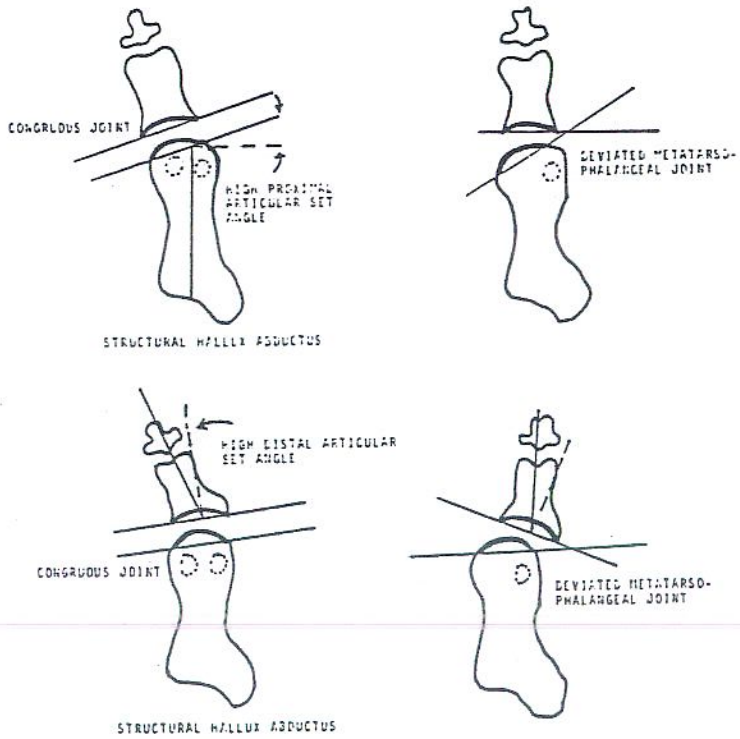

Figure 6. Structural hallux abductus corrected by soft tissue procedures. In structural hallux abductus, repositioning the hallux by means of soft tissue correction and capsulorrhaphy yields a rectus attitude to the digit, but very often it functions poorly.

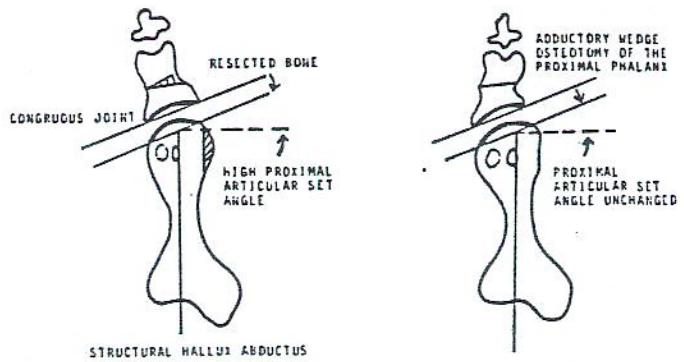

Figure 7. Akin (Giannestras) procedure. The congruous metatarsophalangeal joint is left in its abducted position and a rectus attitude of the hallux is achieved through an adductory wedge osteotomy of the proximal phalanx.

Again, the lateral cortex is left intact. The resultant wedge of bone is excised in toto. The distal aspect of the hallux is manipulated into a medial direction and the osteotomy site is closed. Two drill holes are then placed at the osteotomy site, approximately 3 mm. from the osteotomy site. The osteotomy site is closed, utilizing 28-gauge stainless steel wire and the site is secured. Deep structures are placed in apposition and maintained, utilizing three simple sutures of 3-0 Dexon.© Skin edges are placed in apposition and maintained, utilizing ten simple sutures of 5-0 nylon.

The Peabody procedure is performed in the following manner: A linear incision, approximately 7 cm. in length, is made over the dorsal medial aspect of the first metatarsophalangeal joint. The incision is deepened by blunt and sharp dissection, exposing the capsular structure of the first metatarsophalangeal joint. Two semi-elliptical incisions, approximately 3 cm. in length, are made into the capsule paralleling the skin incision. The wedge of capsular structures are excised in toto. The capsule is now undermined on its medial and lateral and dorsal surfaces and the head of the first metatarsal is delivered into the surgical site. The atrophic portion of bone on the medial aspect of the head of the first metatarsal is now resected. The bone edges are made smooth. A closing adductory wedge osteotomy is now performed on the head of the first metatarsal at the level of the junction of the surgical and anatomical neck. A wedge of bone, with its base directed medially and its apex directed laterally and measuring approximately 0.5 cm. in width at its base, is removed. Two drill holes, one placed in the distal osteotomized head of the metatarsal and one placed in the shaft of the metatarsal, are drilled in the dorsal plantar fashion. The osteotomy site is closed by compressing the distal osteotomized head of the metatarsal on to the proximal shaft of the metatarsal. The osteotomy site is secured utilizing 28-gauge monofilament wire. The capsular structures are now closed and

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maintained utilizing several simple interrupted sutures of 2-0 Dexon. The skin is placed in apposition and maintained utilizing several simple interrupted sutures of 5-0 nylon. Dry sterile dressing and a below-the-knee walking cast are applied.

Thus we see when hallux abductus is structural in nature, an attempt is made to reduce the involved articular set angles via an Akin or Peabody procedure. When the deformity is positional in nature, a soft tissue procedure may be utilized to correct the deviation or subluxation at the metatarsophalangeal joint. If the deformity is both positional and structural in nature, then a combination of procedures may be utilized to correct the deformity.

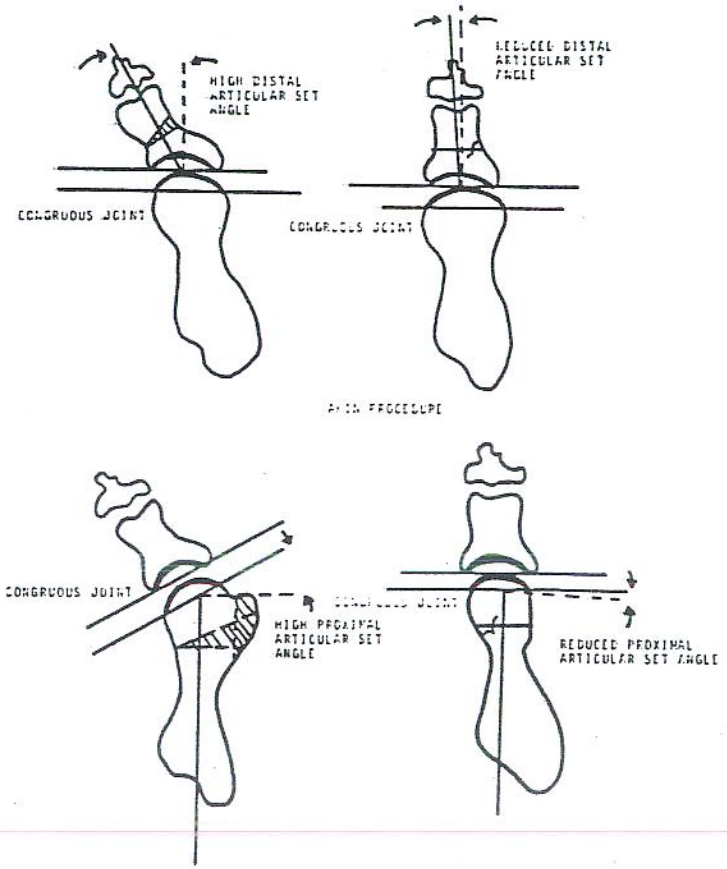

Figure 8. Correction of structural hallux abductus. The Akin procedure is utilized to correct structural abductus where there is a high distal articular set angle. The Peabody procedure is utilized to correct structural hallux abductus where there is a high proximal articular set angle. In each case the exaggerated set angle is reduced.

We have utilized the above procedures to correct uncomplicated hallux abductus. There are, however, some situations which do not lend themselves to correction via these procedures. For example, when there is a high intermetatarsal angle, axial rotation of the hallux in addition to an abductus position or an uncontrollable force.

When there is a high intermetatarsal angle (a great degree of metatarsus primus adductus), re-establishing a "normal" relationship between the articular surface and the long axis of the first metatarsal via a Peabody procedure, will only produce a hallux varus. One must then also attempt to reduce the amount of adductus of the first metatarsal by performing an abductory wedge osteotomy at the base of the metatarsal in addition to reducing the articular set angle.

When there is axial rotation of the proximal phalanx, as well as an abductus position, it is accompanied by dorsiflexion and inversion (supination) of the first metatarsal head. The articular cartilage of the head of the first metatarsal has undergone adaptation not only on the transverse plane (abductus), but also on the frontal and saggital planes (axial rotation—valgus position and elevatus position). The Peabody procedure only reduces the deformity on the transverse plane and a rotational and dorsiflexory, as well as angulational osteotomy, are indicated at the head of the first metatarsal.

When there is an uncontrollable pronatory force in the foot, as seen in a compensated gastrocnemius equinus, the etiological forces of the hypermobility are difficult to control. Any procedures designed to re-establish a first metatarsophalangeal joint which participates actively in the propulsive phase of gait is doomed to failure unless this force can be controlled. Under these circumstances, the surgeon often compromises by doing an arthroplasty on the first metatarsophalangeal joint which will yield a relatively good cosmetic result, but not a functional one.

Two types of uncomplicated hallux abductus are presented: positional and structural. The type of deformity has a great bearing on the surgical approach used to correct the deformity.

When the deformity is: 1) structural—an osteotomy is used to reduce the increased articular set angle or angles; 2) positional—capsular correction is used to reduce the subluxation or deviation of the metatarsophalangeal joint.

When the deformity is complicated by axial rotation of the toe, a dorsiflexory, rotational, angulational and transpositional osteotomy (D.R.A.T.O. procedure) will probably yield the best results. A transpositional osteotomy of the D.R.A.T.O. procedure is performed to reduce the intermetatarsal angle.

Conclusion

There are many bunion procedures utilized to correct hallux abductus; no one is panacea. This is probably due to the many variables involved in the deformity. It is hoped that the above information has increased the surgeon's knowledge to enable him to make a more rational decision when selecting that procedure which will best suit his patient and yield the best results both functionally and cosmetically.

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Among the English language's most puzzling words is "economy," which means the large size in soap flakes and the small size in automobiles.

Pseudo-pseudohypoparathyroidism

A Review of the Syndrome with Particular Reference to Pedal Symptomatology

ALAN HARRIS SHAW, D.P.M.

Pseudo-pseudohypoparathyroidism is manifested by skeletal and soft tissue abnormalities, normal serum calcium values and apparently normal parathyroid function. It presents in the feet usually as shortened metatarsals, joint and digital malformation and exostoses. Metatarsals 4, 3, 1, 5 and 2 are affected in that order. Pseudohypoparathyroidism and pseudo-pseudohypoparathyroidism are probably closely related, the latter being an incompletely expressed form of the complete syndrome. Two case histories are presented.

Pseudo-pseudohypoparathyroidism is manifested by skeletal, soft tissue and mental abnormalities and many of the affected patients demonstrate severe pedal symptomatology. This is due in part to the maldevelopment of various osseous structures in the feet.

The purpose of this paper is to familiarize the reader with the salient diagnostic points of pseudo-pseudohypoparathyroidism and especially to point out the pedal manifestations of the disease. A thorough review of the literature covering pseudo-pseudohypoparathyroidism and some related disorders will be presented along with histories of two current cases with which the author has been intimately associated. Pertinent roentgenologic findings and a discussion pointing out various diagnostic and treatment measures will also be included.

Review of the Literature

A paper on pseudo-pseudohypoparathyroidism would be incomplete without a preliminary discussion of pseudohypoparathyroidism. The term pseudohypoparathyroidism was coined by Albright in 1942 (1) to designate a syndrome characterized by tetany, hypocalcemia, hyperphosphatemia and a decreased excretion of calcium and phosphorous in the urine suggesting true hypoparathyroidism. However, the patients failed to respond to injection of parathyroid hormone and examination of the parathyroid glands revealed them to be normal as opposed to fibrotic, sclerotic, atrophic or otherwise affected by degenerative processes as seen in true hypoparathyroidism. Thus, Albright felt there was a lack of response of the end organs (kidneys and bone) to the hormone for which reason the condition was called pseudohypoparathyroidism or the "Seabright bantam" syndrome (2), alluding to a species of fowl in which the male retains female feathering, not responding, apparently, to the administration of male hormone as in other