One-stage surgical correction of rigid pes cavovarus between 10-14 years of age.

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Abstract

Introduction
The presentation for patients with pes cavus is quite variable. The goal of surgery is to provide a plantigrade foot.
Patients and methods
Ten patients with rigid pes cavovarus foot deformity were included in this work. The mean age was 12 years. The patients received one-stage surgical treatment in the form of tendoachillis lengthening, planter fascia release, calceneal Dwyer osteotomy, laterally based closed wedge cuboid osteotomy and open medially based first cuniform osteotomy, dorsally based closed wedge osteotomy of the base of the first metatarsal bone .
Results
The mean final clinical score at the end of follow up was 76.6 points. There were 9 patients (90%) had satisfactory final results and one (10%) had unsatisfactory results. Eight patients (80%) had a final excellent clinical score of 80 points, one (10%) had good score of 72 points and one (10%) had a fair score of 54 points.
Conclusion
One stage surgical correction of all components of rigid equinocavovarus foot deformity in adolescence was a successful procedure.

Key words
pescavus, foot, osteotomy, equinocavovarus, surgery.

Introduction

Pescavus is a high arch of the foot that does not flatten with weight bearing. No specific radiographic definition of pescavus exists. The deformity can be located in the forefoot, midfoot, hindfoot, or a combination of these sites.[1]

The pescavus foot is either a plantarflexion of the forefoot on the hindfoot, or dorsiflexion of the hindfooton the forefoot producing a high arched foot deformity in the sagittal plane. The deformity may has a multiple associated deformities associated with the sagittal plane deformity in the form of (metatarsus adductus, tarsal supinatory or pronatorymalalignment)in the transverse plane.If the cavus deformity is present only in the non-weight-bearing position,it is considered a flexible type.If the deformity is present in the weight-bearing position,it is considered a rigid one.[2,3]

It was classified in to; Type I, Type II and Type III according to the complixity of the deformity and the surgical procedures required for correction. Type I or mild pescavus, is primarily flexible cavovarus foot typeand primarily a forefoot deformity. Type II is moderate pescavus deformity, is more rigid in presentation and has not only sagittal, but also multi-planar components. Type III pescavus, or severe pescavus deformity, is an advanced multi-planar deformity of the forefoot and hindfoot and associated with neuromuscular imbalance.[3-7]

Pescavus is believed to be idiopathic, familial, old clubfeet, polio, rheumatoidarthritis, residuals of compartmental syndromes, neurologic disturbance and sequelae of midfoot, talar, or calcaneal fractures, some forms of tarsal coalation.[8]

The presentation for patients with pescavus is quite variable, based on the extent of deformity. Patients can present with lateral foot pain from increased weight bearing on the lateral foot. Metatarsal giadue to plantar keratosis.,Ankle instability especially in patients with hindfootvarus.[9]

Surgical decision-making requires a careful and complete examination of the foot and ankle, especially for rigidity, strength, and deformities. The goal of surgery is to provide a plantigrade foot.[4,10,11]

Patients and methods

Ten patients with rigid pescavovarus foot deformity

were included in this work. Six were due to recurrent clubfoot and 4 were idiopathic. the idiopathic cases were diagnosed after exclusion of any other cause by thorough clinical and neurological examination (including neurological studies and consultation of a neurologist).The mean age was12years (range; 10 to 14 years).The right side was affected in 6 patients, the left side in 4.There was no family history in all patients. Four patients of those with recurrent clubfoot had received a soft tissue release operation at younger age. Clinically; rigid heel varus(-ve Coleman block test)[12] was present in all patients. Fixed ankle equines, high medial arch, planter flexion of first metatarsal, tight planter fascia and forefoot adduction were present in all patients. Metatarsalgia due to calluses under the first and fifth metatarsal heads was present in 6 patients. Eight patients had had calluses and pain on the lateral side of the foot. Mild clawing of the toes was present in 4 patients.

Standing anteroposterior (AP) views of both ankles (the same cassette), both feet (the same cassette), and lateral views of each foot and ankle together on the same cassette, Oblique views of both feet were performed to exclude tarsal coalitions. Radiographic data from the lateral standing views (Fig.1)[10] were; Meary's angle[13](N=0^o-5^o), the average was 31^o (range;25^o to 45^o). Calcaneal pitch angle[14] (N =0^o - 30^o), the average was 7^o(range 5^o to 15^o). Hibbs' angle[4] (N<45^o), the average was 70^o (range;55^o to 80^o). Weight-bearing tibioplantar angle[4] (N= 90^o),the average was 120^o (range;110^o to 140^o).

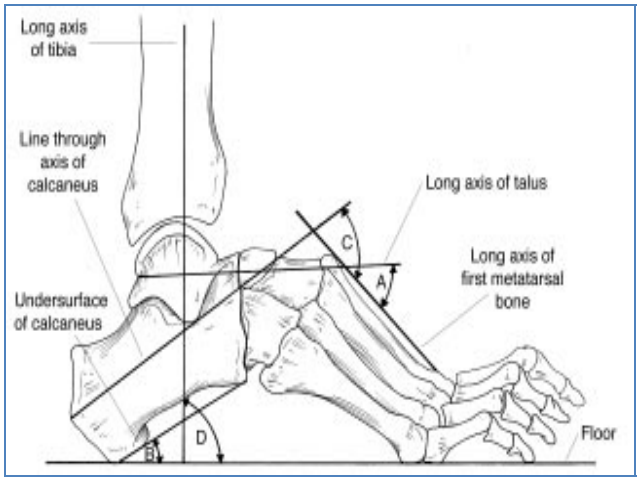

Fig.1. Radiographic angles for evaluating lateral weight-bearing radiographs. A = Meary's angle (N =0^o-5^o). B = Calcaneal pitch angle (N= 0-30). C = Hibbs' angle (N=<45). D = Weight-bearing tibioplantarangle (N=90).(10)

Standing AP radiographs of the feet reveal diminution of the talocalcaneal angle, overlap of the metatarsals and metatarsal adductus in all patients.

The patients received one-stage surgical treatment in the form of tendoachillis lengthening to correct the ankle equinus, planter fascia release, calceneal Dwyer osteotomy[15] (laterally based closed wedge) to correct the heel varus, laterally based closed wedge cuboid osteotomy and open medially based first cuniform osteotomy to correct metatarsus adductus, dorsally based closed wedge osteotomy of the base of the first metatarsal boneto correct the fixed planter flexion of first metatarsl[16,17]. Tendoachillis lengthening was performed througha postero-medial incision to the tendon. Calceneal and cuboid osteotomies were performed through a lateral incision on the foot. Medial cuniform and the base of the first metatarsal osteotomies were performed through a medial incision on the foot. Planter fascia realease was performed through a small incision on the planter aspect of the foot, the osteotomies were fixed by Kirschner wires A below knee plaster cast was applied at the end of the operation(Fig.2).

Post-operatively, the patients were advised to ambulate with crutches without weight bearing on the operated side for a period of 2 months. After 2 months the cast and the wires were removed and another weight bearing cast was applied for one month.

The patients were followed up clinically and radio graphically for a mean period of 20 months (range, 12 to 48 months).

At the end of follow up;A modification of American Orthopaedic Foot

Society Clinical rating system for midfoot (AOFAS) was used for better representation of Pescavus deformity. The total score was 90(40 points for pain, 50 points for function). The scores were grouped as Excellent (73-90), Good (59-72), Fair (46-58) and Poor (0-45).[18]

Results

The mean final clinical score at the end of follow up was 76.6 points. There were 9 patients (90%) had satisfactory final results (Fig. 3) and one (10%) had unsatisfactory results. Eight patients (80%) had a final excellent clinical score of 80 points, one (10%) had good score of 72 points and one (10%) had a fair score of 54 points.

The average Meary's angle at the end of follow up was 5^o (range;0^o to15^o), it was corrected in 7 patients (70%) with average angle of 3^o (range; 0 to 5^o). There were 3 feet (30%) with a Meary's angle of 15^o ; two feet were clinically corrected with a final clinical score of 80 points and one had a fair final score of 54

points.There was a statistically significant differences between the mean meary's angle before treatment and that at the final follow up (P= 0.001) but it had no statistically significant relation with final clinical score (P=0.245).

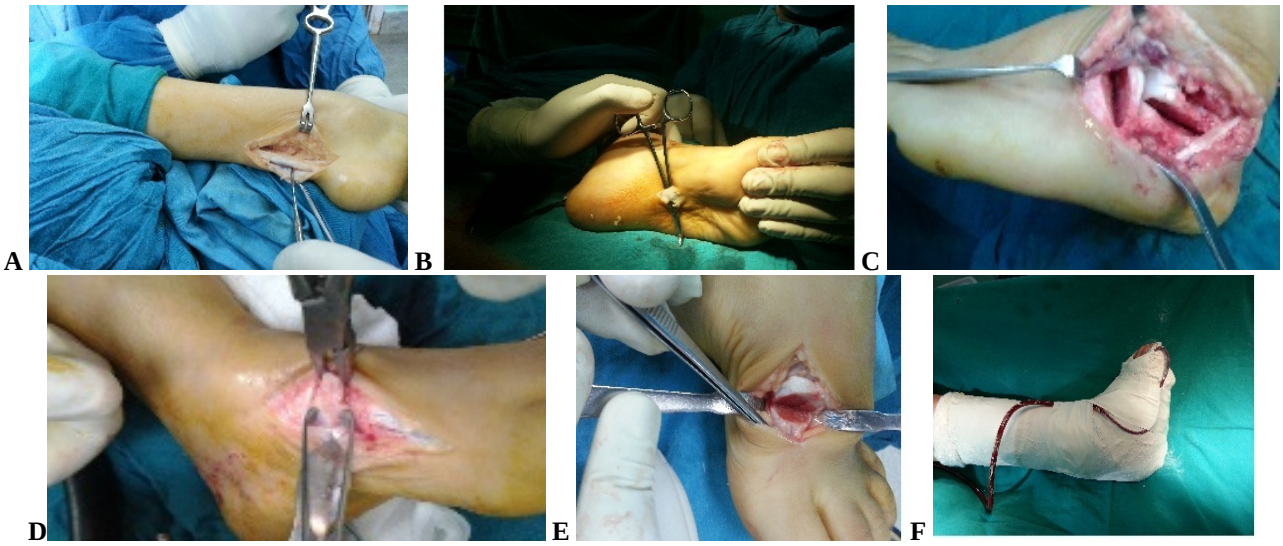

Fig.2. A; Tendoachillis tenotmy. B; Planter fascia release. C; Calceneal and cuboid osteatomy. D; Medial cuneiform osteatomy. E; Osteatomy of the base of the first metatarsal. F; Drainage and below knee plaster cast.

The average calceneal pitch angle at the final follow up was 25^{o} (range; 15^{o} to 30^{o}), there was statistically significant difference with the preoperative one (P=0.000), also it had a statistically significant relation with final score(P=0.002).

The average Hibb's angle was 30^{o}(range; 20^{o} to 45^{o}), there was statistically significant difference with the preoperative one (P=0.001) but it had no statistically significant relation with final score(P=0.110).

The weight bearing tibioplanter angle was 90^{o} in all patients at the final follow up except one (120^{o}), this patient had a fair final results. The forefoot adduction was corrected in all patients.

There was statistically significant difference between the clinical scores preoperatively and at the final follow up (P=0.003). Although, the better results were obtained in the younger age patients(eight patients with excellent results were below 12 years old), the age had no statistically significant effect on the final results (P=0.450).

Fig.3. A,B; 10 –year-old male with right equinocavovarus deformity. C,D; 12 month postoperative with complete ankle and foot correction , final excellent clinical score of 80 points.

Discussion

The successful treatment of pescavus has been a challenge. The goal of surgical management is to obtain a mobile plantigrade foot with correction of the cavus deformity. There is no single surgical procedure, that could be universally applicable to the pescavus deformity. The type of procedure depends on patient age, level of activity, nature and severity of the deformity, and etiology of the condition .Surgical procedures can be broadly categorized into soft-tissue and bony procedures. No single procedure is appropriate for all patients, and frequently, multiple individual procedures need to be performed.[19]

Osteotomies are preferred to fusions whenever possible. Stiff or fixed first metatarsal plantar flexion is treated with a V-type osteotomy of the bone, just distal to the tarsometatarsal joint. Severe, entire forefoot pronation deformities also may require osteotomies of the second and thirdmetatarsals. In addition to the metatarsal osteotomies, a V-type osteotomy of the midtarsal bones, through cuneiforms and cuboid, may be necessary in very severe deformities. If the hindfoot is stiff and does not correct with

the Coleman block test, a calceneal osteotomy frequently is indicated . Planter fascia release and tendoachillis lengthening also were performed in the treatment of the equinocavus foot.[20]

The results of surgical intervention are difficult to compare because of the multiple possible combinations of procedures necessary for successful treatment. Also, patients have varying degrees of deformity, disease progression, and underlying etiology, making comparison virtually impossible.

Naudi et al[21] reported radiologic and clinical results with anterior tarsectomy in 39 cases (33 patients) of pescavus. Pain decreased considerably in 75% of cases, and 68% of patients recovered normal activity. The foot was aligned correctly in 67% of cases, but at last follow-up, pescavus remained underc orrected in 80%. In 74% of feet, adjacent joints showed progressive osteoarthritic degeneration. Subjectively, 70% of patients were very satisfied or satisfied with minor reservations, and objective outcome was excellent or good in 66% of feet. According to the authors, the overall results of the study showed that outcome in terms of function, motion, complications and satisfaction was good, but pain relief results were poor. They added that anterior tarsectomy is able to correct initial pescavus deformity and compensate anomalies of the hindfoot, but its correction capacity is limited and its efficacy in case of clawfoot is poor. In this study; (90%) had satisfactory final results and (10%) had unsatisfactory results. Eight patients (80%) had a final excellent clinical score of 80 points, one (10%) had good score of 72 points and one (10%) had a fair score of 54 points. At the last follow up; 90% of the feet were subjectively corrected and objectively satisfied in spite of the meary′ s angle was under corrected in 30% of feet.

Mansoor MA[18] reported the results of surgery in 33 patients with a mean follow up of 65 months, Excellent to good results wereshown by 90% of patients who had soft tissue surgery only, 65% with metatarsal osteotomy, 57% with Cole's dorsalnndtarsal wedge arthrodesis and 40% with Jahss′s[4] tarsometatrsal truncated wedge arthrodesis.He concluded that soft tissue procedures are most useful for correction of flexible deformity especially in youngerpatients. Bony procedures should be performed for rigid deformity in skeletaly mature patients. Proximal metatarsal osteotomy give better outcome as compared to other midfoot osteotomies/arthrodeses. Watanabe 1990[17] described 84% success rate with metatarsal osteotomy compared with 65% of Mansoor[18] study and 90% excellent to good results in this study.

Jahss in 1980[4] described a technique in the form of a dorsal truncated wedge was removed at the tarsometatarsal joints. He reported excellent results in regard to relief of metatarsal pain, calluses and deformity in patients with mild to moderate deformity and satisfactory results in more severe cases. Mansoor[18] reported good results in 2 feet (40%), fair in one foot (20%) and poor in 2 feet (40%) with the same technique.In this study, a dorsolaterally based closed wedge of the cuboid and adorsomedially opened based wedge of the medial cuniform osteotomies were performed with success rate of 90%.

Most authors who have discussed operative management of pescavus deformity include triple arthrodesis as aconsideration. Triple arthrodesis removes theshock absorber function of the middle and hind parts of thefoot. The ankle is subjected to increased stress. Wukich et al demonstrated radiographic evidence of degenerative joint disease in 62% feet and 24% ankles which had triple arthrodesis for pescavus in Charcot Marie Tooth disease.[22] Triple arthrodesis was avoided in this study to avoid the problem of the arthritis of the adjacent joints.

Conclusion

One stage surgical correction of all components of rigid equinocavovarus foot deformity in adolescence was a successful procedure. A combination of soft tissue and bony procedures should be performed probably to obtain excellent to good results. Correc-

tive osteotomies were better than arthrodesis in this age group.

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