ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 02 | February - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

POLYMETATARSIA FOOT - A COMPILATION AND THE SOLUTION TO THE MYSTERY, AS TO WHEN AND WHEN NOT TO; SURGICALLY INTERVENE.

Orthopaedics

Dr. Jamal Mohamed — Professor, Dept. Of Orthopaedics, Chettinad Hospital & Research Institute (CH&RI), Kelambakkam, Chengalpattu District, Tamil Nadu - 603103.

Dr. Arun Kumar C — Assistant Professor, Dept. Of Orthopaedics, Chettinad Hospital & Research Institute (CH&RI), Kelambakkam, Chengalpattu District, Tamil Nadu - 603103.

Dr. Swetha Saravanan — CRRI (Intern), Dept. Of Orthopaedics, Chettinad Hospital & Research institute(CH&RI), Kelambakkam, Chengalpattu district, Tamil Nadu - 603103.

Dr. Venkatachalam .K* — Professor and HOD Dept. Of Orthopaedics, Chettinad Hospital & Research Institute (CH&RI), Kelambakkam, Chengalpattu District, Tamil Nadu - 603103. *Corresponding Author

Dr. Ampalaya Manu Raghunathan — PG MS(Ortho), Dept. Of Orthopaedics, Chettinad Hospital & Research Institute (CH&RI), Kelambakkam, Chengalpattu District, Tamil Nadu - 603103.

Dr. S.Mothis Kumar — CRRI (Intern), Dept. Of Orthopaedics, Chettinad Hospital & Research Institute(CH&RI), Kelambakkam, Chengalpattu District, Tamil Nadu - 603103.

ABSTRACT

Post-axial polydactyly is an unusual, congenitally inherited deformity. We present some rare IVth metatarsal variants of supernumerary osseous toe digit, in which, the additional osseous element from the IVth bony metatarsal, also articulates with the lateral most ray's proximal phalanx. We deliberate about the operative management, of these types of deformities using an osseous transfer from the additional osseous metatarsal, to within the midfoot, so as to reconstruct a near normal metatarsal anatomical structure. There are only a few reported cases of the IVth Osseous metatarsal variant, of supernumerary metatarsal variant, surgically intervened by osseous transfer, of the extra osseous metatarsal, secured by ORIF to replicate a near normal MTP articulation. The usual positional alignment of the MTP joint, and its cosmesis are significant determinants, while choosing the bone to be excised, in these rare instances, of lateral ray foot polymetatarsia, without poly-dactyly.

KEYWORDS

Polymetatarsia, Poly-dactyly, Os-intermetatarseum.

INTRODUCTION:

Polydactyly, is an rare congenital anomaly of the foot. Post-axial polydactyly is characterized as an extra numeral digit on the outer half of the foot and has been differentiated into 7 variants: the fifth and the fourth metatarsal variant, floating variant, variant involving the proximal, middle and the distal phalangeal variant. We hereby detail, certain rare cases, of instances of polymetatarsia, with an unclassifiable variant, with a lateral duplication of the fourth metatarsal, with an abnormal articulation to the lateral ray Vth proximal phalangeal bone. We endeavored adopting a surgical technique to transfer the metatarsal laterally in the midfoot region.

CASE DISCUSSION:

A young male of Eighteen years, came to the Ortho OPD, with complaints of a right sided foot deformity and pain in the distal lateral part of the foot. Physical assessment, divulged a super-numerary digit of the right side of the Vth ray of the post axial variant, with mild swelling in the disto-lateral part of the right foot. The patient had consistent pain, while walking and mild pain even at rest, mal-orientation of the MTP joint on the right side, was also present. The MTP range of movement, was at 20°of flexion, dorsal-wards and 10° of flexion, plantar-wards. Callosity was found to be present, on the fifth toe base, on the plantar aspect, with pain. The patient had no past medical ailments, or any other related orthopaedic or systemic disorders, and his family history was negative. The clinical findings of rest of the lower limb assessment, were found to be in order, with nil remarks.

Fig. 1(a and b) : Clinical pictures of the foot from the dorsum, demonstrating the outward inclination of the 5th toe and a significant disto-dorsal swelling on the lateral aspect of the Right foot.

Fig. 2(a and b) : X-ray of right foot (AP and Oblique view) showing the mal-articulation of the additional 4th MT with 5th toe. Note also that there exists a pseudo joint between both the 4th and 5th MT heads.

Fig. 3 : 3D CT Right foot, showing the additional osseous units and the bizarre articulations.

Radiographs of the right side foot showed, an additional osseous unit originating juxta-laterally from the IVth MT bone. The additional osseous unit, had formed an additional MT joint, with the shaft of the IVth MT bone to the Vth MT head and also with the Vth, proximal of the 3 phalanges. Thus, there was also a duplication, of the distal phalanx of the Vth toe and a pseudo articulation between the extra IVth MT head and the Vth MT head, in proximity to the 5th MTP Joint, in which it was rather the IVth MT head, that was found articulating with the 5th toe base of proximal phalanx. The pre-operative Lesser Toe Score (American Orthopaedic Foot and Ankle Society) was at 50. The surgical indicators, were that of sustained pain and limitation of ROM, at the MTP Joint, further for him, it was also a matter of cosmetic issue.

PAIN (40 points)	None	40
	Mild occasional	30
	Moderate, daily	20
	Severs, almost always present	0
FUNCTION (45 points)	Activity Limitation	
	No limitations	10
	No limitation of daily activities, limitation of recreational activities	7
	Limited daily and recreational activities	4
	Severe limitation of daily and recreational activities	0
FOOTWEAR REQUIREMENTS	Fashionable conventional shoes, no inserts required	10
	Comfortable footwear, shoe insert	5
	Modified shoes or brace	0
MTPJ MOTION	Normal or mild restriction (75° or more)	10
	Moderate footwear, shoe inserts (30-74°)	5
	Severe restriction (less than 30°)	0
IPJ MOTION	No restriction	5
	Severe restriction (less than 10°)	0
MTP STABILITY	Stable	5
	Definitely unstable or able to dislocate	0
CALLOUS	Related to lesser MTP-IP	
	No callous or asymptomatic callous	5
	Callous, symptomatic	0
ALIGNMENT (15 points)	Good, lesser toe well aligned	15
	Fair, some degree of lesser toe malalignment observed, no symptoms	8
	Poor, severe malalignment, symptomatic	0

Fig. 4 : American Orthopaedic Foot and Ankle Society (AOFAS) Lesser Toe Score. [1]

We decided, to surgically intervene, upon the patient. The proximal part of the additional metatarsal bone was exposed with a dorsal zig-zag incision made along the lateral side of the fourth metatarsal. The interossei muscles were also found to be fibrosed. The so called base, of the additional MT was in some form of articulation with a small roof of the midshaft of the IVth metatarsal, by the articular cartilage. To protect the articulation, between the additional metatarsal and the fifth proximal phalanx, the additional metatarsal was transposed to the zone of the fifth metatarsal shaft. Extra bone from the 5th MT was excised, and was utilized as bone graft material. Internal fixation was performed with a mini-plate and with cortical screws.

Fig. 5(a and b) : .X-ray showing numbered segments, which bone units were excised, transferred, and internally fixated. (A) Pre-operative and (B) early post-operative radiographs, clearly displays the neat realignment of the Vth ray.

Three years after the surgery, the implant was exited. Other than minimal bony spur formation on the medial side of the newly fused fifth metatarsal bone, sufficient bone union was by then accomplished. Post-operatively, the patient remained symptom free. The radiograph demonstrated a normal orientation of the MTP Joint . After normalizing of the MTP direction, the MTP range of movement was improved to 40° of flexion, dorsally and 20°of flexion, plantar-wards, with no residual pain. The final Lesser Toe Score also had significantly improved to 95from that of 50.

Fig. 6 : X-ray Right foot after 3 yrs follow up. Restoration of near normal anatomy visualized radiographically.

Case Illustration: 2

Fig. 7: Clinical photograph showing the widening of the midfoot on the right side foot.

Fig. 8 : X-ray of Right foot demonstrating the rudimentary super-numerary 4th metatarsal which needed surgical excision which is abutting, the dividing digital vein, artery and digital nerve, causing pain and numbness in the lateral 2 toes.

Case Illustration:3

Fig. 9 : Clinical photograph showing the plantar aspect. Note the increase in the gap between the 4th and the 5th toe.

Fig. 10 : X-ray Left foot showing a typical Os-intermetatarseum, trying to make a pseudo-articulation with the proximal 5th metatarsal head.

Fig. 11 : 3D CT of Left foot showing a typical case of Os- inter metatarseum, which again needed to be surgically intervened, as it was acting as a spreader-bar and causing a radiating pain to the, 4th and 5th toes.

Fig. 12 : Post-op X-ray of Left foot after excision of metatarsal bar (Os-intermetatarseum). The bone had to be protected in a load bearing Ankle Foot Orthosis, for a period of 3 months, post-operatively to prevent any pathological fracture in the 5th metatarsal.

DISCUSSION:

"Poly" is a Greek derivative, for "many" and "dactylos" is a Greek derivative, for "digits". [2] This condition can also be addressed as hyperdactyly, which represents a congenital anamalous supernumerary toes or/and fingers.[3]Deformities of the congenital origin, occur in about 2% of the newborns, of these deformities involving the extremities is about 10%. [4]Usually it is a result of a mutation at the short end of chromosome no. 7, and is inherited, as an allele that is dominant. Anyways most of them, may not be, at all functional. Out of every five hundred newborns, one may be affected by the condition of poly-dactyly.

Poly-metatarsia, without super-numerary digits are rare to come by. [4] This condition should not be confused with the identity of Os-intermetatarseum, which again, is a rather a rare accessory bony anomaly.[5] Again poly-metatarsia, when it occurs, it is usually accompanied by polydactyly. According to Ishii et al; this condition is a result of contiguity fusion, of over induced phalanges, after induction of excessive digital bony ray formation. [6]Hayashi et al; went on to clarify that herein, there is a dual embryological failure i.e., on the one hand a duplication, occurring at the metatarsal level, and the other hand, is either a fusion or a failure to separate at the level of phalanges. [7] Similar case of post-axial polydactyly were also reported by Lee et al; .[8] Surprisingly however, not all cases of poly-metatarsia, are symptomatic and hence there exists no thumb rule, to fit all categories of polymetatarsia. Cosmesis and intractable pain, due to sole pressure un-uniform distribution, alone forms the basis of surgery and not their functional short-comings, as the surgery itself may not be able to restore the ROM, to near normal.

A plantar approach is always better not only from the cosmesis view point, but also gives us a wider in-sight, into the pathology perse. A painful Tailor's bunion, have also been considered, as an indication for surgical intervention. [4]Poly-metatarsia, therefore is a anamolous duplication of one or more of the metatarsal bones. Conclusively one can say, that it is a metatarsal bone, if there is a demonstrable growth plate, and presence of an articular cartilage, upon surgical exposure and its location is typically in the space between 4th and 5th metatarsals. Ongino T et al; had highlighted that the embryological fault lies in the "Ridge Apical and Ectodermal Zone", in the early stage of embryonic development.[9]

The teratogenic mechanism, as proposed by Ongino T et al; and Horii E et al; [9,10]also finds our backing and support, with respect to fusion concept of phalanges, after abnormal digital ray induction. Pain characteristics, sometimes mimic metatarsalgia, or occur due to digital nerve impalement or impingement. Mapping of dynamic foot pressure(Fig. 13) force and timing information, for foot function and gait analysis are done, prior to and after surgical excision, in order to, document the benefit of, the surgical intervention.

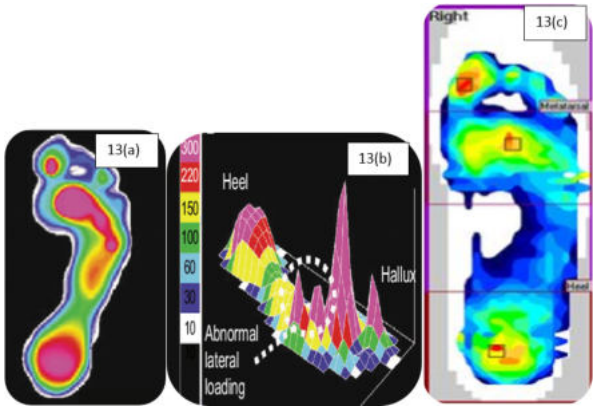

Fig. 13 (a, b, c) : Foot pressure scan- Pre-op and Post-op evaluation. Note that the abnormal lateral loading has been addressed to, effectively post surgically.

CONCLUSION:

Poly-metatarsia of 4th and 5th metatarsal, may at times need to be surgically intervened upon. Only the appropriate cases, need to be operated. Many other variants require specialist podiatrist consultation, to provide them for "custom made" foot wear or in-sole inserts.

REFERENCES:

1. Feeney, S., Rees, S., & Tagoe, M. (2006). *Hemiphalengectomy and Syndactylization for Treatment of Osteoarthritis and Dislocation of the Second Metatarsal Phalangeal Joint: An Outcome Study. The Journal of Foot and Ankle Surgery, 45(2), 82–90.* doi:10.1053/j.jfas.2005.12.003
2. AN A, MK G, N R. Postaxial polydactyly [Internet]. PubMed. 2021 [cited 2 January 2021].
3. Little, K. J., & Cornwall, R. (2016). Congenital Anomalies of the Hand—Principles of Management. Orthopedic Clinics of North America, 47(1), 153–168.doi:10.1016/j.ocl.2015.08.015
4. Wessel, L. E., Daluiski, A., & Trehan, S. K. (2019). Polydactyly a review and update of a common congenital hand difference. Current Opinion in Pediatrics. doi:10.1097/mop.0000000000000871
5. Aswegen, T., Low, R., & Pass, B. (2020). Os intermetatarseum: An analysis of morphology and case reports of fracture. Journal of Medical Imaging and RadiationOncology. doi:10.1111/1754-9485.13095
6. Ishii, T., Kawabata, H., Kuratsu, S., Miki, K., & Yoshikawa, H. (2005). Two cases of complete polymetatarsia without polydactyly. British Journal of Plastic Surgery, 58(2),

267–270. doi:10.1016/j.bjps.2004.10.018
7. Suzuki, A., Kawabata, H., Hayashi, J., & Tamura, D. (2019). Clinical Findings and Treatments of a Radially Deviated Type of Thumb Polydactyly. The Journal of Hand Surgery (Asian-Pacific Volume), 24(01), 17–23. doi:10.1142/s2424835519500048
8. Guo B, Lee SK, Paksima N (2013) Polydactyly: a review. Bull Hosp Jt Dis 71:17–23
9. Ogino, T., Ishii, S., Takahata, S., & Kato, H. (1996). Long-term results of surgical treatment of thumb polydactyly. The Journal of Hand Surgery, 21(3), 478–486. doi:10.1016/s0363-5023(96)80366-2
10. Horii, E., Hattori, T., Koh, S., & Majima, M. (2009). Reconstruction for Wassel Type III Radial Polydactyly With Two Digits Equal in Size. The Journal of Hand Surgery, 34(10), 1802–1807. doi:10.1016/j.jhsa.2009.07.018