



## Post Traumatic Clawing of Foot

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### Abstract

**Introduction:** Clawing of toes of foot are usually seen in neuromuscular disorders, but in some instances, after trauma to leg, which may be accompanied with fracture or not, after healing of fracture or soft tissue injuries, clawing deformity of foot may be appeared. We try to determine the cause of it and the most appropriate treatment for it.

**Materials and methods:** We study about 106 patients in sina hospital (Tehran, Iran) from 2000 to 2007. After confirmation of ethical approval, they enter our study. All of them were our original patients whom for their first trauma were referred to emergency room of our hospital. 101 of them had fracture of leg but in 5 cases there were no fracture of leg. In the follow up visits of them, we see there is clawing of foot so we examine them for sensory and motor function and take radiography and electromyography (EMG) of lower extremity. We do tenotomy of flexors of their toes and remove callosities if necessary.

**Findings:** There were no sensory or motor deficit in their traumatized lower extremities and also there were no abnormality in their EMG. In the X rays of them, there were no obvious or huge callus mass. In the radiography of their foot, there were no fracture of foot bones and also no abnormality of their toes like malunion or destruction of small joints of their feet.

**Conclusion and discussion:** We try to rule out some causes of clawing of foot. There were no checkrein effect of fracture callus and in EMG, there were no nerve injury and there were no bony abnormality in X rays. They have only unilateral problem and their clawing begins after trauma so neuromuscular diseases can be ruled out.

We think a fibrotic event after crush injury to calf muscles can produce this deformity.

**Keywords:** Clawing; Foot; Trauma

### Introduction and Background

Clawing of toes which mean flexion contraction of proximal interphalangeal joint (PIP) and distal interphalangeal joint (DIP) of toes and extension contraction of metatarsophalangeal joint (MTP) [1] is usually a feature of neuromuscular disorders of musculoskeletal system like charcote mary tooth [2], poliomyelitis [3] and cerebral palsy [4]. Clawing of this type is an intrinsic muscle injury. Intrinsic muscles of foot are dorsal and plantar interosseous muscles and lumbricals which naturally because of their attachments to tendons of toes, can flex MTP joint and extend DIP and PIP joints. So, if they are non functional because of primary muscle disease or muscle dysfunction secondary to lack of their nerve supply (traumatic or nerve disease), the resultant imbalance of flexors and extensors of toes [5], cause flexion deformity of DIP and PIP and extension deformity of MTP joints of toes which named clawing deformity. These conditions have known clinical and paraclinical characters such as special features in electromyography, nerve conduction velocity EMG/NCV [6] or muscle biopsy [7]. The features of these starts from child hood [8] and progress during maturity ages and have sensory and/or motor deficits [9]. Some other causes can produce deformities in toes which can be mistaken with clawing. One of them is malunion of toes [10]. It may be happened if in the trauma event, initial examination and work up is incomplete so fracture of small bones of toes might be missed and they united in bad position and produce a deformity similar to clawing. But, because there is no intrinsic muscle injury, the complete deformity is not appeared and also all of toes are not involved (usually one or two toes are fractured). This malunion is obvious in simple radiography of foot. The other cause may be a checkrein deformity [11-13] which produce a similar deformity. In this category, a huge callus formation in the fracture site of tibia or rarely a heterotopic bone formation in soft tissues of leg, can deviate flexor tendons of calf muscles and stretch them so flex the toes when the patient try to put the ankle in neutral

position. In this instance, with more dorsiflexion of ankle, the deformity is exaggerated and with plantar flexion of ankle, the deformity is seems milder. In the X rays of them, almost always, a calcified mass around tibia is seen. We call these type of clawing deformity "pseudoclawing" because there is no intrinsic muscle dysfunction of foot. The clawing deformity may be flexible (it means that the deformity can be corrected manually) or nonflexible and rigid (which cannot be corrected manually). Because of bad posture of toes during shoe wearing, there may be callosities over DIP or PIP joints of toes which can be a source of pain or discomfort during gate. The classic operation for correction of this deformity acts on extensors and the involved joints from dorsal surface. But, we introduce a procedure for correction which acts on flexors from plantar surface.

### Materials and Methods

Between years 2000-2007, we study 143 cases of clawing after trauma to leg in sina hospital, Tehran Iran. We emphasized an ethical approval from our colleagues that this study is humanized and will be done with permission of patients. If in follow up visits of patients after trauma to leg, deformity of toes were seen, they enter the study and demographic information of them were written in information papers.

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Then, through physical examination, sensory and motor function of their leg and feet and deformity of foot and ankle such as clawing and location and size of callosities were written in charts. Flexibility of deformity was examined (correctable with manipulation means flexible and noncorrectable with manipulation means rigid). An X-ray of their leg and foot were done and also electromyographic study (EMG/NCV) of their lower extremities was done. In physical examination, sensory and motor condition of legs and feet were evaluated and also flexibility of deformity was noticed. Then, in cases with fixed deformity and minimal manual correction and no huge callus in X ray of tibia and no evidence of malunion of toes, surgery is done. Through small incision below each toe in the middle phalanx, tenotomy of flexor tendons was done and if there were callosities over PIPs, we remove them and underlying extensor tendon and joint capsule with elliptical incisions and then approximate remaining tissues to each one (dermodesis). In some cases with sever clawing, stabilization of toes in corrected position were done with Steinmann pins for 3 or 4 weeks. In follow up visits in 2<sup>nd</sup> week and 4<sup>th</sup> week and 8<sup>th</sup> week and 3 months and 6 months, recurrence of deformity and difficulty in shoe wearing was mentioned. If a patient can not follow the post operative visits, it was omitted from study. Analyses of data were done with t-test by statistical analysor of our department.

## Results

At the end of study, 106 cases were remained for study. 80 were male (75.5%) and 26 female (24.5%). 78 of them were left (73.5%) and the remaining 28 were right (26.5%). In 13 cases (12.25%) the problem were bilateral. In 92 cases (86.8%) tibia and fibula fracture were seen but in 9 (8.5%) there were only fibula fracture and in 5 cases (4.7%) there were no fracture in tibia and fibula. Average age of patients is 32 years (from 18 to 48 years). The contributing trauma was motor cycle accident in 89 cases (84%) and in the others (16%) direct blow to leg were mentioned. In all of them range of motion of ankle diminished from normal (specially dorsiflexion 20°) and circumferential measurement of calf muscles shows atrophy in comparison with the other one (except in the bilateral cases). In EMG/NCV studies of them, no obvious deficit was seen and interestingly, interosseous muscles of foot remained intact. In 88 cases (83%) deformity were rigid and in the remaining (17%) deformity were partially rigid.

In 78 cases (73.5%) Achilles Tendon Lengthening (ATL) besides correction of clawing of toes were performed and in 18 cases (16.5%) ATL and posterior capsulotomy of ankle joint were performed for correction of sever equinus deformity. In all of them, tenotomy of long flexor of toes through small incision under toes were performed but in 101 cases (95%) it was accompanied with removing of callosities over DIP and PIP of phalanges. No bony procedure was done for them. Mean operation time for each leg was 40 minutes (between 30 to 55 minutes) but a great part of this time were occupied with ATL or capsulotomy not for tenotomy and correction of clawing.

## Discussion

After healing of primary injury (crush, fracture,...) some minor complications will be appeared and can cause some problems for patient. One of them is clawing deformity of toes after healing of fracture or crush element of injury. It seems that it is not checkrein effect of fracture site callus because in radiographies of them there was no huge callus [14] around fracture site. It is not a neuromuscular clawing because it appears only after a known trauma to leg not from

childhood and also in majority of cases it is unilateral (in opposite to neuromuscular clawings which mostly were seen bilaterally).

It differs from malunion of toes because of special deformities and also no signs of malunion in radiographies of feet. There was no nerve damage in EMG/NCV. So, I think it may be a sequel of mild compartment syndrome [15] which remains subclinical and only after fibrosis of muscles and contraction of them, it shows itself as clawing of toes. It differs from trough clawing because in trough clawing or neuromuscular clawing, there is identifiable problem in intrinsic muscles of foot and the imbalance of muscles [16] produce the classic clawing deformity, but, in these patients, intrinsic muscles of foot remain intact and the source of deformity is calf muscles. It is possible to release muscles or lengthening the tendons in distal part of leg [17], for example behind medial malleolus, but there is a dangerous site and the main neurovascular bundle of extremity locates there so with a great operation, at first dissection of neurovascular bundle must be done then the main operation performed. Also, there may be problem with skin coverage in distal part of leg (skin slough). But, we only cut the deforming tendons trough a minimal incision in the plantar surface of toes without risk of injury to main neurovascular elements of toes. If needed, ATL may be performed trough a separate incision in classic site [18] for ATL or for cosmesis or improving shoe wear, with small elliptical incisions over DIP or PIP removing of callosities may be done and then skin will be repaired. In the follow up visits, there was no problem with skin of foot and there was no recurrence of deformity. There was only one case of over correction of deformity (hyperextension of interphalangeal joints) which need a corrective surgery for its new deformity. There was no injury to artery and nerves and all of the patients were satisfy from the appearance of their feet and they can wear their shoes comfortably. So, we offer this method as a safe and effective way for correction of "POST TRAUMATIC CLAWING" of toes. It differs from classic treatment of claw toe wick acts on extensors and dorsal surface of toes. We think because flexed posture of toes is the main cause of problems like callosity formation over PIP joints and in the tip of toes and consequently pain and problem with shoe wearing, it is better to operate the flexor tendons to correct the deformity.

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