IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 4 Ver. V (April. 2017), PP 109-113
www.iosrjournals.org

ThePrevalence and Pattern of Foot Dropin A Private Orthopedic and Trauma Center, South East, Nigeria: A10 Year Retrospective Analysis.

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Abstract
Background:*Foot drop from trauma or from any other cause can be devastating to the orthopedic patient especially as it prolongs rehabilitation. The inability to dorsi-flex the foot distorts the gait cycle with exaggerated clearance and poor heel landing which could lead to instability and occasional falls. Our objective is to find out the scope of this problem in our center.*
Patients and methods*: The patients diagnosed with foot drop primarily or as complication of other orthopedic conditions between January 2006 and December 2015 were studied retrospectively by analyzing their case files.*
Results*: A total of 1638 case files of patients who had foot drop or who had orthopedic problems considered high risk for foot drop were analyzed. Eighty five (5.2%) had foot drop from either nerve or musculo-tendinous injury. Majority of them were aged 10 years and below n= 55 (65%) and they were mainly due to intra-muscular gluteal injection affecting the sciatic nerve. Young adult males between the ages of 21-40 years n=23 (27.1%) had their foot drop from major trauma, p value <0.05. Expectant treatment lead to full recovery in many cases n=40 (47.1%), p value < 0.05. Further treatment with physiotherapy, orthotic fixture, nerve exploration, tendon transfer and seldom ankle arthrodesis was done for the few that did not recover n=2 (2.4%).*
Conclusion: *Foot drop is a fairly common complication encountered in orthopedic practice. This could occur from complicated orthopedic injuries affecting the nerves and muscles secondarily or from their primary involvement which could be iatrogenic. Although watchful waiting and resolution over time could occur in many cases especially when there are no indications for emergency interventions, those that do not resolve could be treated by surgeries.*
Keywords*: Foot drop, Prevalence, Pattern, Gait, Ankle dorsi-flexion, South-east Nigeria.*

I. Introduction

Foot drop is the inability to dorsi-flex the ankle and toes and this may be primarily related to neural or musculotendinous injury or both. In the gait cycle, the ankle and toe extensors act as agonists to clear the foot from the ground in the swing phase and during heel strike in the stance phase, they act as antagonists to the plantar flexors and so prevent heavy landing of the foot [1]. When the functions of these extensors are deranged, the patient lift the foot high to prevent the toes from scratching the ground and this high stepping gait could result in instability and occasional falls [1].The anatomical or pathophysiological abnormality of the common peroneal nerve at the neck of fibular is the commonest cause of foot drop [2].However, there are also central causes of foot drop like motor neuron disease, multiple sclerosis, amyotrophic lateral sclerosis, spinal stenosis and Parkinson disease [2], [3]. Peripheral neuropathies involving the L5 root in lumbar disc herniation and occasionally in lumbar degenerative disease can also result in typical foot drop [4]. Sciatic nerve irritation and stretching following injuries or surgeries around the hip like dislocations orarthroplasty[5] and injury to the deep peroneal nerve that is sometimes observed in tibia fracture orcompartment syndrome of the leg also cause foot drop. This study which is probably one of the few in our environment describes the scope of foot drop in our orthopedic facility with the aims of highlighting the prevalence, the etiologies, the treatment and the outcomes.

II. Patients and methods

Ethicalapproval. The study was approved by the ethical committee of First Choice Specialist Hospital where it was carried out after due considerations of all issues concerning human research.

Study setting and design. This is a retrospective review of case files of the patients who were seen in our facility primarily for foot drop or who were seen for their primary orthopedic ailments that were complicated by foot drop. The facility is a 25 bedded specialist orthopedic and trauma centerlocated in a south eastern Nigerian city, with an average 218 patients admission annually.

Data collection. The case files of these patients that were routinely kept with the medical records were retrieved using one or more of the following search words--hip dislocations, lower limb fractures, leg

compartment syndrome, fibular neck fracture, tibia osteotomies and foot drop. Additional information were also obtained from the operation register master list where applicable. The information collated were age, sex, side, etiology, results of electro-myographic studies where applicable, treatment carried out and outcome. Those that had foot drop of central origin that were not directly concerned with orthopedics and trauma were excluded from the study.

Technical intervention. The diagnosis of foot drop were mainly clinical. The inability to activelydorsi-flex the ankle and the toes in comparison with the contralateral side was unmistakable (figure 1). Presence or absence of sensation on the lateral aspect of the leg and foot sometimes pin-points to the level of injury and etiology. Medical Research Council grading for power was used to determine the degree of muscle weakness. Some of the patients especially those that were admitted primarily for foot drop also had electro-myographic studies. The recognizable etiologies like hip dislocations also guided the diagnosis and treatment.

Statistical analysis.

The data were subjected to statistical analysis using Statistical Package for Social Sciences software by International Business Machine (SPSS IBM for Windows) version 20, Armonk, NY, USA 2011. Statistical Inferences were considered significant when p value is < 0.05.

III. Results

Eighty five patients had foot drop, majority of them n=45 (53%) were due to intramuscular gluteal injection and they were 10 years and below and this was statistically significant p <0.05 as shown in Table 1 and 2.The young adult males, 21-40 years had their foot drop mainly from major trauma to the hip joints and from tibia fracture and compartment syndrome of the leg (Table 2). There was also a significant involvement of the right foot than the left (Table1).

Table 1: showing the age and sex and side distributions of foot drop treated within the period under review

Age (years)	No. of patients (%)	Male	Female	Right	Left
1-10	55(65)	24	31	41	14
11-20	2(2.4)	2	0	2	0
21-30	12(14.1)	9	3	5	7
31-40	11(13)	10	1	6	5
41-50	2(2.4)	2	0	1	1
51-60	3(3.5)	1	2	2	1
Total	85(100)	48	37	57	28

Majority of the patients with foot drop are 10 years and below, P <0.05, R: L =2.01: 1 P value < 0.05

Apart from intramuscular gluteal injection causing sciatic nerve irritation and foot drop, other common causes of foot drop were related to significant traumas such as hip dislocation with or without fracture, tibia fracture with compartment syndrome and deep lacerations involving the tibialis anterior and the long extensors of the toes as shown in Table 2 below. Iatrogenic causes of foot drop such as overzealous correction of genu varumwere not common and accounted for 1.8%, n=2 out of 109 corrective osteotomies done.

Table 2: shows the distribution of foot drop according to etiology and the proportionate number of patients seen during the period

Etiology	No. of foot drop (%)	Total no. of patients	percentage
Posterior hip dislocation	13(15.3)	91	14
Acetabular fracture, central dislocation	2(2.4)	14	14
Gluteal injections	45(53)	45	100
Gunshot injury to the buttock	3(3.5)	3	100
Lumbar degenerative disease	3(3.5)	286	1
Proximal fibular exostosis	1(1.2)	9	11
Tibia fracture + compartment syndrome	8(9.4)	662	1.2
Femoral fracture	1(1.2)	412	0.2
Tibialis anterior +/- toes extensor lacerations	6 (7.1)	6	100
Corrective tibia osteotomies	2(2.4)	109	1.8
Infrared heat therapy	1(1.2)	1	100
Total	85(100)	1638	5.2

Intramuscular gluteal injection was the main etiological factor in foot drop p<0.05 followed by hip dislocation and tibia fracture whichwerealsostatistically significant.Watchful waiting while treating the primary pathology resulted in a significant resolution of the foot drop as shown in table 3 below. When an active intervention is required like in acute compartment syndrome of the leg or laceration of extensor tendons or

common peroneal nerve compression from fibular neck exostosis (Figures 2 and 3) almost total resolution of the foot drop was obtained. However, if recovery was delayed, further treatment ranged from nerve and muscle stimulation, active and passive ankle range of motion exercises, ankle foot orthosis (AFO), nerve exploration, and occasionally tendon transfers and ankle arthrodesis as shown in table 3.

Table 3: showing the distribution of treatment carried out and treatment outcome according to the etiology

Etiology	No. of patients	Treatment	Outcome (full recovery)	Further treatment
Hip dislocation	15	Close reduction +traction+expectant	12	2 physiotherapy 1 anti-foot drop device
Gluteal injection	45	expectant	27	18 nerve and muscle stimulation and ankle foot orthosis
Gunshot injuries	3	expectant	1	1- tendon transfer 1-ankle arthrodesis
Lumbar degenerative disease	3	expectant	0	3 physiotherapy+ AFO
Proximal fibular exostosis	1	Excision + neurolysis	1	Nil
Tibia fracture + compartment syndrome	8	Fasciotomies	7	1- tendon transfer
Femoral fracture	1	ORIF, neurolysis	0	1 ankle arthrodesis
Ankle extensor tendons lacerations	6	Primary repair	6	Nil
Corrective tibia osteotomy	2	Removal of splints and temporal return of varum deformity	2	Nil
Infrared heat therapy	1	expectant	0	1 anti-foot drop device
Total	85 (100)		56 (65.9)	29 (34.1)

A high number of patients recovered by watchful waiting P value < 0.05.ORIF open reduction and internal fixation

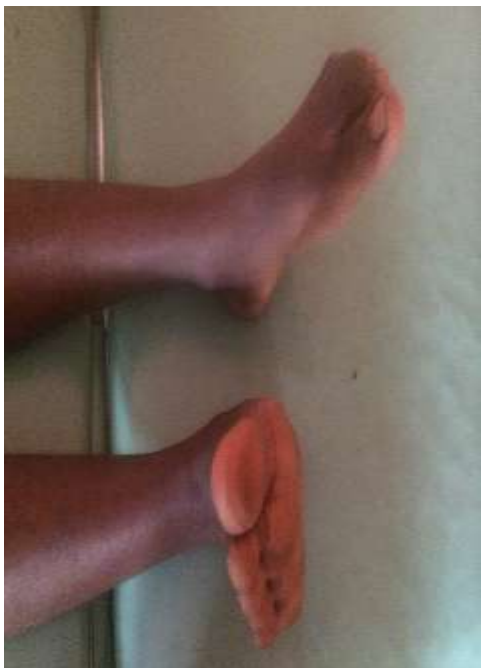

Fig 1Clinical photograph showing the inability to activelydorsi-flex the left foot in comparison with the right.

Fig 2 Plain radiograph of knee of same patient showing fibular neck exostosis.

Fig 3 Intra-operative photograph showing the tumor and the common peroneal nerve. E-exoxtosis, N –common peroneal nerve.

IV. Discussion

Foot drop is a fairly common complication encountered in orthopedic practice [1]. It is not a disease but a clinical manifestation of either a neural injury or muscular injury or both affecting the ankle dorsi-flexors [1]. Following any major trauma, an additional foot drop prolongs the rehabilitation of the patient and this obviously would account for increased cost of treatment and postponementof return to normal activities of daily living.Many of the patients in this study were children who had primary injuries to their sciatic nerves through inappropriate sitingof intramuscular gluteal injections. Such injections were commonly for the treatment of malaria and infections. Many right hand dominant persons find it easier to pull down their pants from the right hand side for intramuscular gluteal injections or more often the parents straddle these children from their left hand side, thus exposing their right buttocks for these injections and these could explain the dominance of right foot drop. Thepredominance of males with foot drop in the age bracket 21-40 yearsfollowingmajor traumas could be explained on the basis of greater risks taking by young adult males in their pursuits for daily living and recreation.

It is a common knowledge that posterior hip fracture dislocation could be associated with sciatic nerve injury. Because of the close proximity of the nerve to the posterior anatomy of the hip joint, stretching and perineural hematoma result in physiological interference in nerve conduction. This neuropraxia is expected to resolve overtime. This is usually before the end of 6 weeks from time of injury or at most 6 months post injury[1] without intervention except for the treatment of the primary cause which in most cases is closed reduction and traction as seen in this study. A significant number of our patients with hip dislocation had foot drop. This is unlike in tibia fracture with uncommon compartment syndrome n=8 (1.2%) out of 662 tibia fractures. The uncommon presentation of compartment syndrome has been reported in other study [6].Incidentally, all of the patients with compartment syndrome had foot drop and this is not unexpected as the anterior or the extensor compartment is most commonly affected [7] and it is in this compartment that the deep branch of the common peroneal nerve runs. Early diagnosis and release of the intra-compartmental pressure by fasciotomy before irreversible damage,resulted in the complete recovery of foot drop in most of the patients. Similar results were noted in other studies[6],[8],[9]. When the primary cause of foot drop is recognizable like compression of common peroneal nerve by fibular neck exostosis or by tight anti thrombosis compression stockinet,[10] or by fibular tunnel syndrome,[11] or by simple ganglion or Baker's cysts [12], [13], the only chance of recovery is to treat the

primary cause. In our study, the only patient with foot drop resulting from fibular neck exostosis had a full recovery following the removal of pressure effect on the nerve by the tumor through excisional biopsy and neurolysis (Figure 3).

Interestingly, an iatrogenic cause of foot drop which is largely preventable is the overzealous correction of severe genu varum or valgum deformity. One stage correction of the deformity is a potential cause of stretching of the neurovascular structures and the muscles in the leg. This invariably causes compartment syndrome. Though this is a not very common, once foot drop or any evidence of compartment syndrome is observed, any external splint should be removed and the limb returned to near its original alignment. Unfortunately, these were the situations with 2 out of 109 corrective osteotomies in our study. For severe deformities, serialtwo or more staged manipulation under anesthesiaafterosteotomies in the first few weeks post operation is advisable. However, this presupposed that external splints and not hardwarewere used to immobilize the osteotomies. It is important to monitor the distal circulation by finger palpation or pulse oximetry. The other option is to risk marked limb length inequality by combining a shortening with angulationosteotomies.The stretching of sciatic nerve and consequent foot dropas prosthesis placed in a high offset caused limb lengthening had been reported inatotal hip arthroplasty,[5]also was common peroneal nerve stretch during total knee replacement [14]. A very rare case of overheat from infrared lamp causing burns and common peroneal injury was also reported in this study and the foot drop persisted for several months and the patient was advised to use dynamic anti foot drop device.

A complete laceration of the sciatic nerve may follow gunshot injuries to the buttock. The locations of pellets on plain radiographsand or Computerized Tomography Scan and nerve conduction test may suggest the site and severity of injury especially when expectant recovery was not achieved and thesecouldalso guide the need for surgery. The timing for nerve exploration and repair is important to avoid theirreversiblesecondary changes in the muscles and the joints that occur over time.However, physiotherapy, static AFO and dynamic anti foot drop device could be used during the waiting period to reduce these changes. Surgical options of microsurgical nerve transfers[15] and tibialis posterior transfer through the interrosseous membrane to tibialis anterior attachment[16] have been reported with variable outcomes.Our two cases of tendon transfers were not enough to draw any inference. This also applied for the cases of arthrodesis even though the deformities were corrected to provide stable ankle joints.

V. Conclusion

Foot drop delays the speed of rehabilitation in orthopedic patients. The orthopedist should prevent it as much as possibleby taking the necessary precautions in high risk surgeries.Though many would recover after watchful waiting, some will need various types of active interventions especially where there are established causes and this may include surgery to achieve a stable planti-grade foot.

Conflict of interest- None
Sponsorship-the first author conceptualized and funded the study.

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