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Open motorcycle wheel spoke achilles tendon injury among children in A Suburban African setting

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Abstract

Introduction*: Achilles tendon injury is commonly a sport-related closed injury in the developed countries, while in the developing countries; it is commonly an open vehicular accident related injury. The effect of the injury on children can have a long-term consequence if poorly managed.*
Materials and Methods*: This is a prospective study aimed at knowing the pattern of presentation and outcome of motorcycle-related Achilles tendon injuries among children ina rural hospital in Southern Nigeria between January 2010 and December 2015.*
Result*: A total of 28 patients who met the inclusion criteria were seen during this period. The male-to- female ratio was 1: 3. Those mostly affected are primary school children within the ages of 6-10. The mean duration of hospital stay was 2.04±1.48 weeks. Most of the patients [85.7% (n=24)] achieved a power of grade 4 using the Medical Research Council Muscle Power Grading System scale at 1 year. The complication rate was 10.7% (n= 3).*
Conclusion*: Those most at risk of motorcycle-related Achilles tendon injury are children of primary school ages. The outcome of primary repair and physiotherapy is encouraging.*

Keywords: Achilles tendon, motorcycle wheel spoke, children, suburban

Introduction

The Achilles tendon is formed mainly by the gastrocnemius and soleus muscles. These muscles are the chief factors responsible for propulsion in walking, running and jumping.[1] The Achilles tendon acts mainly at the push-off stage of walking and more so in running when the heel remains off the ground. Injury to this tendon will impact negatively on these actions.

Achilles tendon got its name from a warrior and hero of Homer's Iliad who led the Greek military forces to capture and destroy Troy after killing the Trojan prince, Hector. He was immersed in river Styx by his mother, Thetis, as a way of protecting him from physical harm. However, the heel by which he was held during this process remained untouched by the water and thus his body had a vulnerable point. It was at this vulnerable area that Hector's brother, Paris, fired a poisoned arrow to avenge the death of his brother.[2]

In the developed countries where sporting activities are well organized, the commonly reported mechanism of Achilles tendon injury is a rupture during sport.[3,4,5]They are mainly closed injuries. In developing countries, road traffic accident, from motorcycle and bicycle, is the commonest cause of open Achilles tendon injury.[6,7] Other mechanisms that have been documented to be responsible for Achilles tendon injury are lacerations from broken glass, knives, cutlasses, axes, lavatory pans and rarely sharp edges of fractured bone segments.[6,7,8,9,10,11]

In rural Nigeria, there is no organized public transportation system. This coupled with the poor road networks which are not accessible to passenger cars and buses gave room to the escalating use of motorcycles as a means of transportation. Also, the alarming unemployment rate has made the youth to embrace commercial motorcycle transport as a business. There are studies that found the motorcycle as the most dangerous means of transportation with higher crashes and fatalitieswhen compared to any other passenger vehicle per mile driven.[12] For those who survives the crash, it is one of the commonest causes of limb loss.[13] Despite these observations, the

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use of motorcycle as a means of transporting children to school in the rural and suburban areas is becoming popular, thus putting the limbs of our future leaders at risk.[14,15,16] [Fig 1]

Figure 1: A fresh open Achilles tendon injury

Materials and Methods

This is a prospective study of motorcycle spoke related Achilles tendon injury among children, seen in Irrua Specialist Teaching Hospital, Irrua, Edo State, Southern Nigeria between January 2010 and December 2015.The study centre is a 400-bedded hospital located in a rural area. The facility serves the people of Edo North and Central. It also serves some communities in the neighboring states of Kogi, Delta and Ondo.

After due ethical approval and informed consent collected from patients and their relatives, a structured proforma, filled by the first author and trained assistants (surgical residents) was opened for each patient at the time of presentation and updated during admission and follow-up clinic visit for one year. Data collected included patients' demographics, side affected,surgical procedures carried out, type of cast used in immobilization, duration of hospital stay and complications.The outcome of treatment was also obtained at 1year, using the Medical Research Council Muscle Power Grading System while patient attempts planta-flexing the foot with the surgeon's hand serving as a source of resistance when needed.

Excluded from this study are patients who were 18 years and above at the time of presentation, those that were lost to follow up before twelve-month post-treatment,Achilles tendon injuries not related to motorcycle accident and uncooperative patients.

Data obtained were analyzed using IBM-SPSS for windows (version 20.0 SPSS Inc., Chicago, IL) statistical software package; and presented in tabular and descriptive forms.

Result

A total of 28 patients who met the inclusion criteria were seen during this period. The average age of children affected was 9.89± 4.41 years. The male-to-female ratio was 1: 3. Those within the age group 6-10 years, and primary school children were mostly affected [59% (n=16)][fig 2a and b].

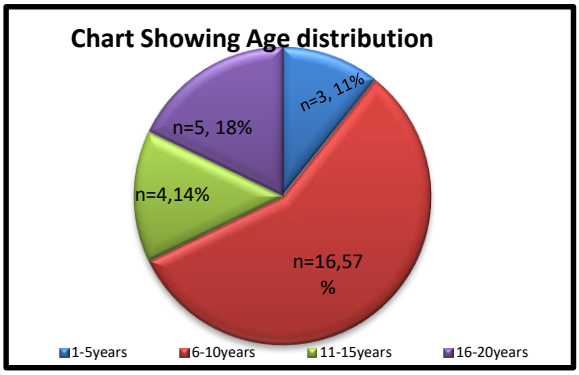

Fig 2a: Chart showing age distribution

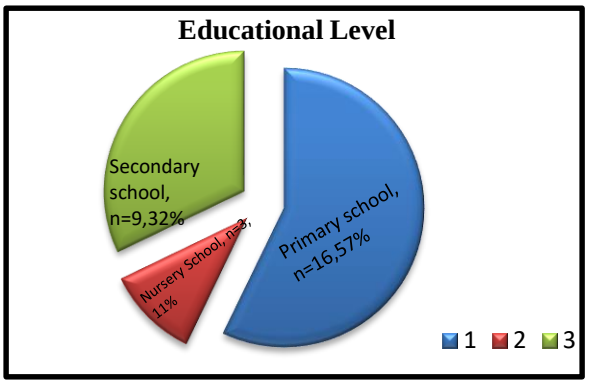

Fig 2b: Educational Level

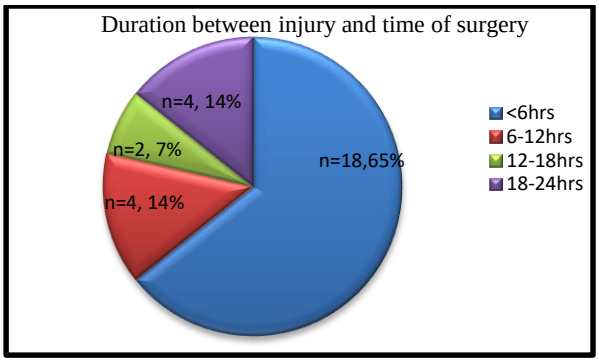

Fig 3: Duration between injury and time of surgery

The right limb was mostly affected, accounting for 67.9% (n=19) while the left limb accounted for 32.1% (n=9). The mean time interval between the injury and

commencement of surgery was 7.35± 7.09 hours. Majority of the patients had their surgery done within 6 hours from the time of injury [64.3% (n=18)] [Fig 3].

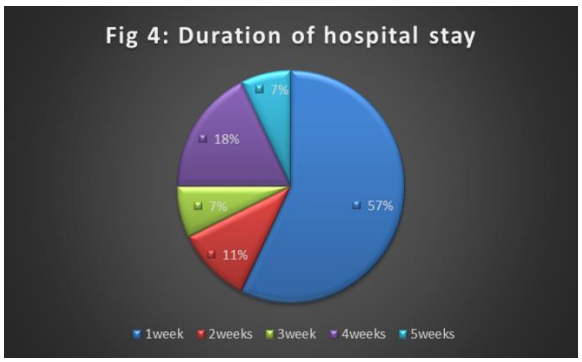

Fig 4: Duration of hospital stay

Modified Kessler tendon repair was used for all patients in this study. Direct edge to edge skin closure was possible in majority of cases [67.9% (n=19)] while the remaining 9 [32.1%] had reversed sural artery adipo-fascial flap with skin grafting. The mean duration of hospital stay was 2.04±1.48 weeks with majority of the patient spending one week on admission.

Table 1: Summary table for motorcycle related wheel spoke injury

		Frequency (n)	Percentage (%)
Level of Education	**Nursery school**	**2**	**7.1**
	Primary School	**17**	**60.7**
	Secondary School	**9**	**32.2**
	Mean age	**9.89 ±4.41**	
Sex	**Female**	**21**	**75.0**
	Male	**7**	**25.0**
	M: F= 1: 3		
Side of injury	**Right**	**19**	**67.9**
	Left	**9**	**32.1**
Skin cover surgery	**A-Direct skin closure**	**19**	**67.9**
	B-Reverses rural artery flap	**9**	**32.1**
Mean duration of cast	**5.41±1.55 weeks**		
Outcome	**MRC-3**	**4**	**14.3**
	MRC-4	**24**	**85.7**
	Mean MRC= 3.81± 0.40		
Complication	**Nil**	**25**	**89.3**
	Wound breakdown	**2**	**7.1**
	Infection	**1**	**3.6**

Boot and above-the-knee casting were the most commonly employed methods of immobilization. The mean duration of casting was 5.41± 1.55 weeks. The mean muscle power grade at 1 year was 3.81± 0.40. Most of the patients [85.7% (n=24)] achieved grade 4 while the rest [14.3% (n=4)] attained grade 3. The complication rate was 10.7% (n= 3) with 2 of the patients developing wound breakdown while one had wound infection. [Table 1]

Discussion

Most epidemiological studies on Achilles tendon injury arefrom developed countries and are frequently sport related.[3,4,5,16] Raikin et al.[18] observed that among 406 consecutive cases of Achilles tendon injury, 68% were sport-related. Other studies by Cetti and Postacchini observed 83% and 44% respectively.[4,5] In rural and suburban Nigeria,closed sport-related injuries like Achilles tendon rupture are hardly seen in the trauma departments becauseof poverty and ignorance of the rural dwellers. Theyare of the belief that closed musculoskeletal injuries are not severe enough to warrant hospital treatment, thus, patronizing the traditional bone setters.[19]

The motorcycle spoke is the commonest cause of Achilles tendon injury in our setting.[6]Of the 57patients we managed during the study period for Achilles tendon injuries, 31 were caused by motorcycle spoke of which 28 met the inclusion criteria.

In Nigeria, organized mass public transportation system is non-existent especially in the rural areas. Despite the dangers of commercial motorcycles, it is becoming the major means of moving persons and goods in rural and suburban communities. Dongo et al[13] reported that motorcycle-related accidents inflictedmore injury to the lower limbthan to any other part of the body. The passenger seated astride this means of transportation, puts his or her heel at the risk of being trapped between the spokes in the wheel of an unstable motorcycle, in the event of a bumpy ride.

Our study reveals that children between the ages of 6-10years are mostly affected. These are mainly children at the primary level of education. This finding is at variance with other studies on Achilles tendon injuries where those in the third and fourth decades are mostly

affected.[16,17] For children, their susceptibility to this injury stems from the observation that the motorcycles are overcrowded while taking a ride to and back from school, thus leaving the kids scampering for spaces on the foot rest [Fig 5].

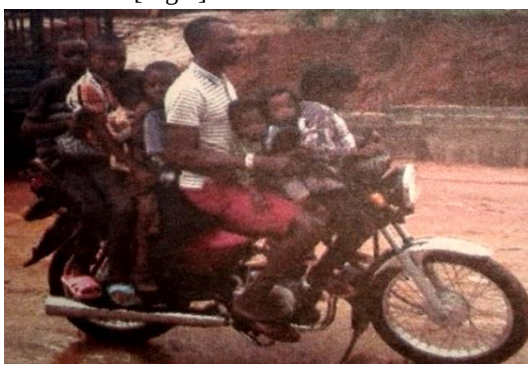

Figure 5: Overloaded motorcycle conveying children

During a bumpy ride, the heel of the hanging limb, when the knee is inadvertently flexed, may be drawnand trapped between the spokes of the moving wheel leading to avulsion of the Achilles tendon. All the cases that presented to our facility were open, and with ragged skin edges.

We observed a female preponderance in our study as against some other studies on Achilles tendon injury from sport where the males are mainly affected.[17,18] This may not be unconnected with the bogus skirts, gowns and wrappers which are the traditional dressings for females in our setting. These dressings may be entrapped within the moving wheel and consequently drag the foot towards the spokes, thus, causing the Achilles tendon entrapment and injury. Most of our patients corroborated this hypothesis in their history.

The right lower limb is mostly affected; this is in contrast with other studies done on Achilles tendon injury.[18-20] All the patients in this study had open injury. There was no case with bony involvement.

Some controversy exists concerning the distribution of blood supply to the Achilles tendon: While some opine that the density of blood vessels is low towards the distal part,[23] others are of the opinion that the blood vessels are evenly distributed.[24] However, the blood supply to the Achilles tendon is better in younger individuals.[25] Based on this information, the preferred technique to be employed in repairing the Achilles tendon should not worsen the already precarious blood supply due to anatomy and the injury. The modified Kessler suturing technique was used in all cases. This is a simple and time-efficient technique that will allow the preservation of blood supply. There were no records of cases requiring tendon flap. [Fig 6]

Figure 6: Modified Kessler repair (intraoperative)

Fig 7a: Outcome at two months post direct edge-to-edge skin suturing

Figure 7 b: Post-operative outcome for reverse artery flap closure

Skin cover for the distal leg and foot is a challenge. Though direct end-to-end skin closure was possible in most cases, there were some patients requiring flap cover of which the reverses rural arteryadipo-fascial flap was used. Unlike the reverses rural artery fasciocutaneous flap where skin from the calf is taken along with the flap, this has the cosmetic advantage of confining the resultant scar within the boundary of the school sock.[Fig 7a and b]

We achieved post-operative immobilization with boot cast for most patients except for suspected active children when we used above-the-knee cast to reduce their activity. This is to allow for progression of wound healing. These were maintained for 6weeks,[4] after which patients were allowed gradual weight bearing under the supervision of the physical therapist. Though most of our patients attained an MRC grade 4 at 1year, the outcome of our treatment can be better if we have a well-equipped physiotherapy unit.

The commercial motorcycle related Achilles tendon injuries are preventable. Effort should be made by the Standards Organization of Nigeria (SON) to modify the design by way of encasing the wheel spokes. Also, education of motorcycle riders and enforcement of road safety laws should be taken to the grassroots. This will curb the incessant overloading of commercial motorcycles and the resultant accidents in our rural areas. Provision of a proper transportation system and good schools, located at trekkable distance, for the children will go a long way to prevent this injury.

Conclusion

While most reported Achilles tendon injuries in advanced countries are spontaneous, closed and related to sporting activities, our study has revealed the prevalence of open motorcycle wheel-related injury in our rural/sub-urban setting. Females of primary school ages are mostly affected. Early open repair gives a better outcome. Proper attention should be paid to rehabilitation and skin cover to achieve good function and aesthetics.

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