Online Early
DOI: 10.7547/22-080

Journal of the American Podiatric Medical Association

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ORIGINAL ARTICLE

Evaluation and Management of Idiopathic Unilateral Foot Drop

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Background: In this study, our purpose is to evaluate patients who were followed by acute developing single-sided foot drop and improving with conservative management or spontaneously.

Methods: Between 2019 and 2020, 10 patients were evaluated for a unilateral weakness of the lower extremity in the form of absent dorsiflexion at the ankle joint and were given a diagnosis of foot drop without any etiological cause. Patients were followed for a period of 18 months. All patients were evaluated for acute foot drop of the affected extremity by utilizing the following diagnostic modalities, EMG, MRI lumbar spine, MRI knee, peripheral MRI neurography and non-contrast brain MRI. Each patient was evaluated for a history of Covid-19 infection over the past year. Patients with any identified cause were excluded.

Results: Initial evaluation of muscle strength in all patients revealed 0/5 by the MRC muscle testing grading scale. (1) In 2 patients, the muscle strength was 3/5 at the 6th month, and in the other 8 patients 4/5 at the 6th month. The muscle strength of all patients improved as 5/5 in 1 year. Six of the patients were dispensed an AFO device and nine patient's performed physical therapy. Evaluation of EMG results identified significant neuropathy at the level of the common peroneal at the fibular head in all patients. In comparison with peroneal nerve stimulation below and above the fibular head in the lateral popliteal fossa; 50% reduction in sensory amplitude, and motor conduction slowing of >10 m/s was present. Evaluation of knee MRI revealed, no masses, edema, or anatomical variations at the level of the fibular head.

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Conclusions: In patients diagnosed with unilateral acute foot drop without an etiological cause, one should keep in mind that spontaneous resolution of this condition can occur within one year period.

Unilateral foot drop is a condition that causes difficulty in walking, often due to peripheral causes. It occurs with loss of dorsiflexion of the ankle. In the etiology of foot drop, there are many causes in addition to fibular head entrapment neuropathy of the peroneal nerve. These include L5 radiculopathy, upper motor neuron diseases; There are traumatic causes such as sciatic nerve lesion, polyneuropathy, lumbar plexus pathologies, penetrating injuries, external compressions such as tight knee bandage, crossed legs, prolonged squatting and space-occupying lesions. (2) Spontaneous foot drop is most commonly seen due to peroneal neuropathy caused by compression of the nerve at the level of the fibula head, where it is covered only by skin and subcutaneous tissue. (3) Gait problems, leg pain, muscle strength and sensory deficits may occur with acute or chronic compression, stretching or trauma on the peroneal nerve before it divides into superficial and deep branches. (4) In our study, we showed that patients who were evaluated in our orthopedic outpatient clinic with the complaint of foot drop and whose etiology could not be identified after conducting evaluation and testing of the peroneal neuropathy, would completely recover with non-surgical treatments.

Patients and Methods

The study was approved by the institutional review board and performed under the ethical standards laid down in the Declaration of Helsinki. Approval for this retrospective study was granted by the Institutional Review Board (decision no:104)

Between 2019 and 2020, 10 patients were examined who were followed up with a diagnosis of foot drop, for which we couldn't detect any etiological cause. These patients are between the ages of 5 and 53 (mean age 23). 3 were female and 7 were male. The affected side of all patients was the right side. 4 patients had a history of chronic drug use. (Table 1) The patients were followed up for at least 18 months. Peripheral neuropathy was detected on EMG after acute foot drop in all patients. There was no pathology detected at L5 plexus in the lumbar region MRIs (Fig. 1). No pathology was detected in the region of the fibular head of the fibular nerve in the knee MRI images of the affected extremity. And in MRI, the morphology of the biceps muscle was normal during the course of the fibula. (Fig. 2) Orthoroentgenogram was taken from all patients, deformity analysis was performed and no angular pathology was found. (Fig. 3) All patients were evaluated for acute foot drop, by taking EMG, lumbar and knee MRI, peripheral MRI neurography of the affected extremity (Fig. 4), and non-contrast brain MRI. (Fig. 5) To identify the etiology, posture, and sitting positions of the patients were examined and no pathology was detected. Detailed anamnesis was questioned and no diagnosed autoimmune or

metabolic disease was detected. They have been checked for whether had a history of covid infection by looking at Covid-19 PCR results over the past 1 year. In all of our patients, the history of trauma was questioned and excluded. The use of an orthosis (AFO), and the process of physical therapy rehabilitation were evaluated. Patients with an identified cause like pathologies pressing on the fibular nerve or cranial or lumbar pathology, and those who had surgical treatment for the cause, were excluded from the study.

Results

The muscle strength at the initial application of all patients was 0/5 according to the medical research council (MRC) scale system. In 2 patients, the muscle strength was 3/5 at the 6th month, and in the other 8 patients 4/5 at the 6th month. The muscle strength improved to 5/5 in 1 year at the latest. 3 patients were using isorethionine, a vitamin A derivative, for acne treatment. One patient was under treatment for hypertension. AFO was applied to 6 patients and 9 patients had to undergo physical therapy. One patient rejected physical therapy but muscle strength improved spontaneously in the 6th month. Vitamin B and NSAİ treatment were given to 9 of the patients. Evaluation of EMG results identified significant neuropathy at the level of the common peroneal at the fibular head in all patients. In comparison with peroneal nerve stimulation below and above the fibular head in the lateral popliteal fossa; 50% reduction

in sensory amplitude (Avg: 4.9 μV, SD: 0.9; Avg: 18,3 μV, SD: 2.32), and motor conduction slowing of >10 m/s (Avg: 33.1 m/s, SD: 2.79; Avg: 59.3 m/s, SD: 6.92) was present. Electrodiagnostic data collected included deep fibular nerve conduction block/slowing, extensor digitorum brevis (EDB)/tibialis anterior (TA) compound muscle action potential (CMAP) amplitude and axon loss estimate, superficial fibular nerve sensory nerve action potential (SNAP) amplitude and axon loss estimate, and needle EMG neurogenic changes in the muscles supplied by the deep versus superficial branches of the common fibular nerve. In the knee MRI examination of all patients, normal MRI findings for the peroneal nerve were observed at the level of the head of the fibula, and no mass that would cause any compression or edema was found. No anatomical variation were detected in the knee MRIs of the patients. Knee MRI identified three of the patients with meniscal degeneration and edema of the ACL fibers Nine of the patients were diagnosed with a covid infection during the past year. The tenth patient who was five years old did not have a PCR performed, however, his family were diagnosed with Covid-19 during the past year. Patients using isotretinoin were found to have mildly elevated liver enzymes. After performing a thorough physical and diagnostic evaluation of each patient, for unilateral foot drop, no etiologic cause could be identified other than each patient had been exposed to the Covid-19 virus. these patients continued their social lives during the follow-up period.

No EMG are retaken or no additional radiological investigations were performed on the patients whose muscle strength improved. During the follow-up period, the patients did not develop new foot complaints.

Foot drop rehabilitation

Patients were treated conservatively. Main goals of treatment were to have a pain-free, stable foot that can dorsiflex voluntarily in a functional gait cycle.

All patients were informed about the prognosis and management of their individual condition. Patients in the acute phase were advised about precautions like avoiding leg crossing, kneeling or squatting. Patients with acute injury were immobilized and treated with oral or local NSAIDs. Life style modifications were encouraged to reduce the risk of falling. Flat shoes with ankle support or ankle foot orthosis (AFO) were prescribed depending on the patients' muscle strength.

All patients were referred to physiotherapy and rehabilitation. For patients with low muscle strength, neuromuscular electrical stimulation (NMES) was administered to prevent muscle atrophy. Rehabilitation program consisted of active or passive daily range of movement and stretching exercises for ankle to prevent development of contractures and rigidity Isometric or resistive strengthening exercises were instructed. An experienced

physiotherapist gait and stair training to each patient in order to achieve safe ambulation. Some of the patients were dispensed a cane to help with ambulation and stability.

Discussion

Throughout the literature several authors have identified many etiologic causes of foot drop. Upton and McComas in 1973, suggested (5) So far, this theory of double crushing is still supported by several authors. (6) However, experience from clinical practice reveals that many patients have additional or competing causes for foot drop. (7) Weakness or loss of dorsiflexion at the ankle is known as foot drop. This may be caused by upper or lower motor neuron deficits. It is most commonly caused by lower motor neuron deficits and mostly due to peroneal nerve neuropathy. Common peroneal nerve compression around the head of the fibula is the most common site of peroneal nerve injury. Other causes of lower motor neuropathy that cause foot drop include sciatic mononeuropathy, lumbosacral plexopathy, polyneuropathy, or severe L5 radiculopathy. (8) Cases of foot drop secondary to ischemia after squatting or crossing legs have been reported in the literature, and some of them were treated with conservative treatment. Timothy et al. also reported idiopathic cases that did not improve in 2 years of follow-up. (9) In our study, muscle strength was 4/5 in the 6-month period, and muscle strength returned to previous function after a one year period of time. Contrary to the

literature, all patients recovered. We attribute this outcome to the rehabilitation process in the early period. Barton et al. mention that conditions affecting the central nervous system, such as Covid-19, cause foot drop. (10) Also, in some case series, the peripheral neuropathy may have been determined to be pathogens such as Covid-19. (11) The common identifier in our study was that each patient either was infected or exposed to covid infection during the past year prior to developing unilateral foot drop. The authors believe that covid infection, in rare cases, can cause foot drop.

It has been reported in some studies that the activity levels and sitting positions of the individuals cause peroneal nerve lesion.(12) Compression of the nerve in this region may lead to foot drop, which may lead to surgical intervention. In our study group, we observed that the patients' activities such as sitting, standing and sports activities have no involvement in injury to the peroneal nerve. Some authors have advocated for the use of surgical nerve decompression in order to decrease the length of time of idiopathic foot drop. (13,14)

When the nerve is followed conservatively it takes time to fully recovery of muscle strength. In our study, we observed that all patients regained their former muscle strength and function at the end of 1 year by following them conservatively.

There are a number of treatment alternatives in the conservative treatment of foot drop. These include rest, NSAI treatment, steroid treatment and orthosis use. (15,16,17) In our

study, we used NSAI drugs and orthoses in 5 patients with pain complaints, consistent with the literature. Four patients refused to use orthoses. Ultimately muscle strength was seen as 5/5 in orthosis users and those who did not use orthosis Despite the small number of cases, we think that orthotic treatment may not have to use in patients whose etiology has not been identified. Vitamin B complex and NSAI drugs were recommended in all patients. Contrary to the literature, no patient received oral or parenteral steroid therapy. Despite the small number of cases, we believe the use of orthotics may be unnecessary for the treatment of foot drop when associated with an unknown etiologic factor.

The most common cause of unilateral acute foot drop is lumbar pathologies. This is mostly caused by L5 radiculopathy.(18) MRI imaging of the lumbar region was performed to rule out this pathology. In our study, no pathology was found in the tests performed on the lumbar region. Although it is rare, foot drop due to anatomical variations has been mentioned in the literature. In order to exclude this, evaluation of MRI examinations has been recommended.(19,20) In our study group, no variation has been found in the MRI scans.

Limitation

The most important limitation of our study was the low number of cases. This number could have been increased if the study was multi-centered. In addition, the EMG was not retaken

because the complaints due to foot drop were resolved and the muscle strength was improved in the patients.

Conclusion

The response of foot drop to treatment varies depending on the etiology. It should be kept in mind that when there is no cause found in the investigation of unilateral acute foot drop that comes to the orthopedic outpatient clinic, functional muscle strength will be improved and peripheral neuropathy can be resolved without surgery in a one-year period.

Financial Disclosure: None reported.

Conflict of Interest: None reported.

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Table 1: Data of the Study Group

Demographics (n=10)							
	Age:	Mean: 25,9 (5-52) SD: 14,6					
	Gender	**Male**			**Female**		
		7			3		
Affected Side	**Right**			**Left**			
	10			None			
Additional Diseases / Drug Use		**Positive**			**Negative**		
	Hypertension	1			9		
	Isotretinoin Use	3			7		
	Covid in 1 Year	1			9		
Treatment		**Received**			**Unreceived**		
	Physical Treatment	9			1		
	AFO	6			4		
	Surgery	None			10		
Muscle Strength		**0/5**	**1/5**	**2/5**	**3/5**	**4/5**	**5/5**
	First Arrival	10	-	-	-	-	-
	6th Month	-	-	-	2	8	-
	1st Year	-	-	-	-	-	10

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Figure 1: Lumbar MRI scans in sagittal and axial section indicate that there is no pathology on L5 plexus

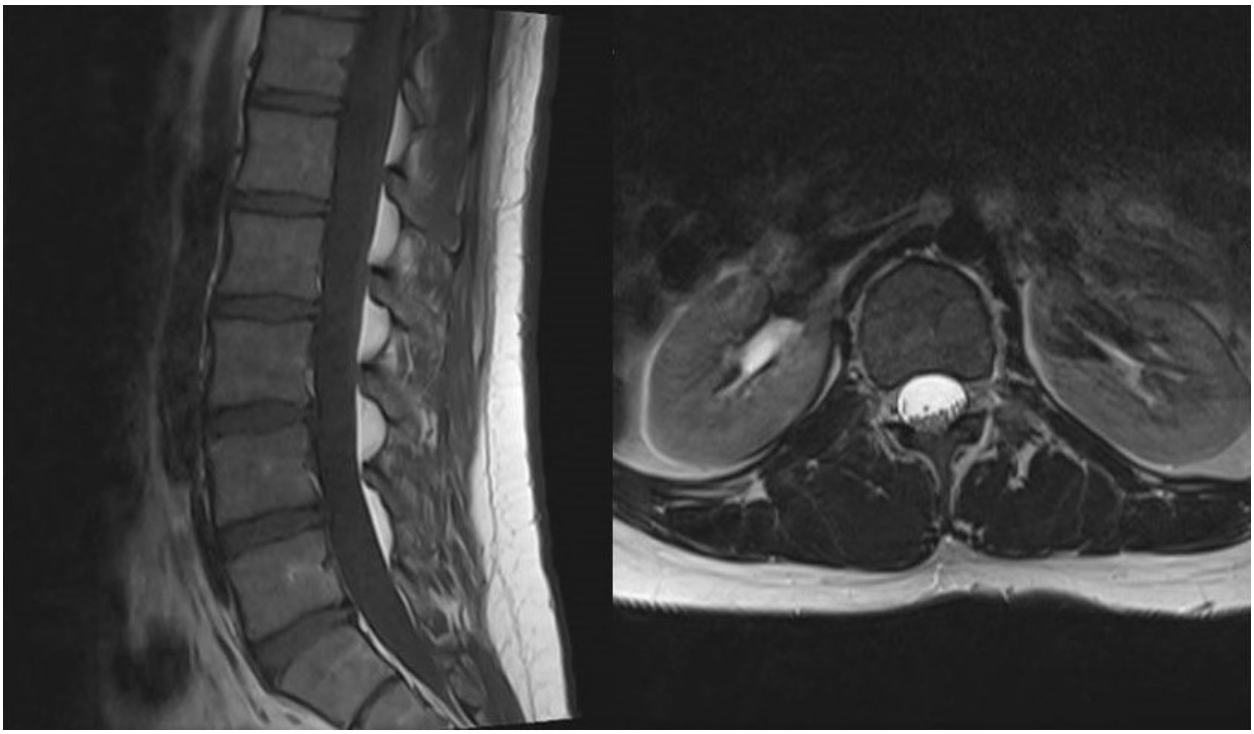

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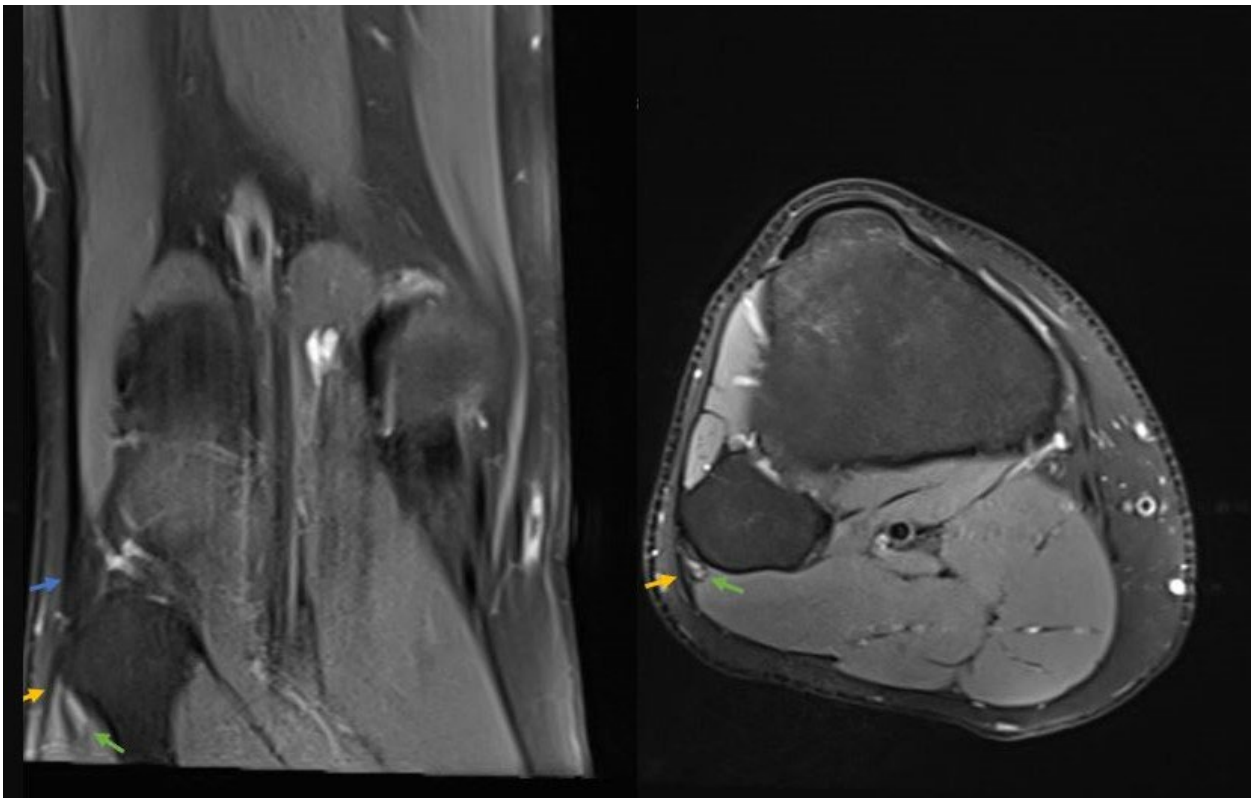
Figure 2: Knee MRI scans shows that the common peroneal (fibular) nerve courses through the popliteal fossa, towards naturally the head of the fibula (green arrow), normal anatomy of fibular insertion of the biceps femoris tendon (blue arrow) and the origin of the peroneus longus tendon, which forms the fibular tunnel, did not cause compression or irritation (yellow arrow)



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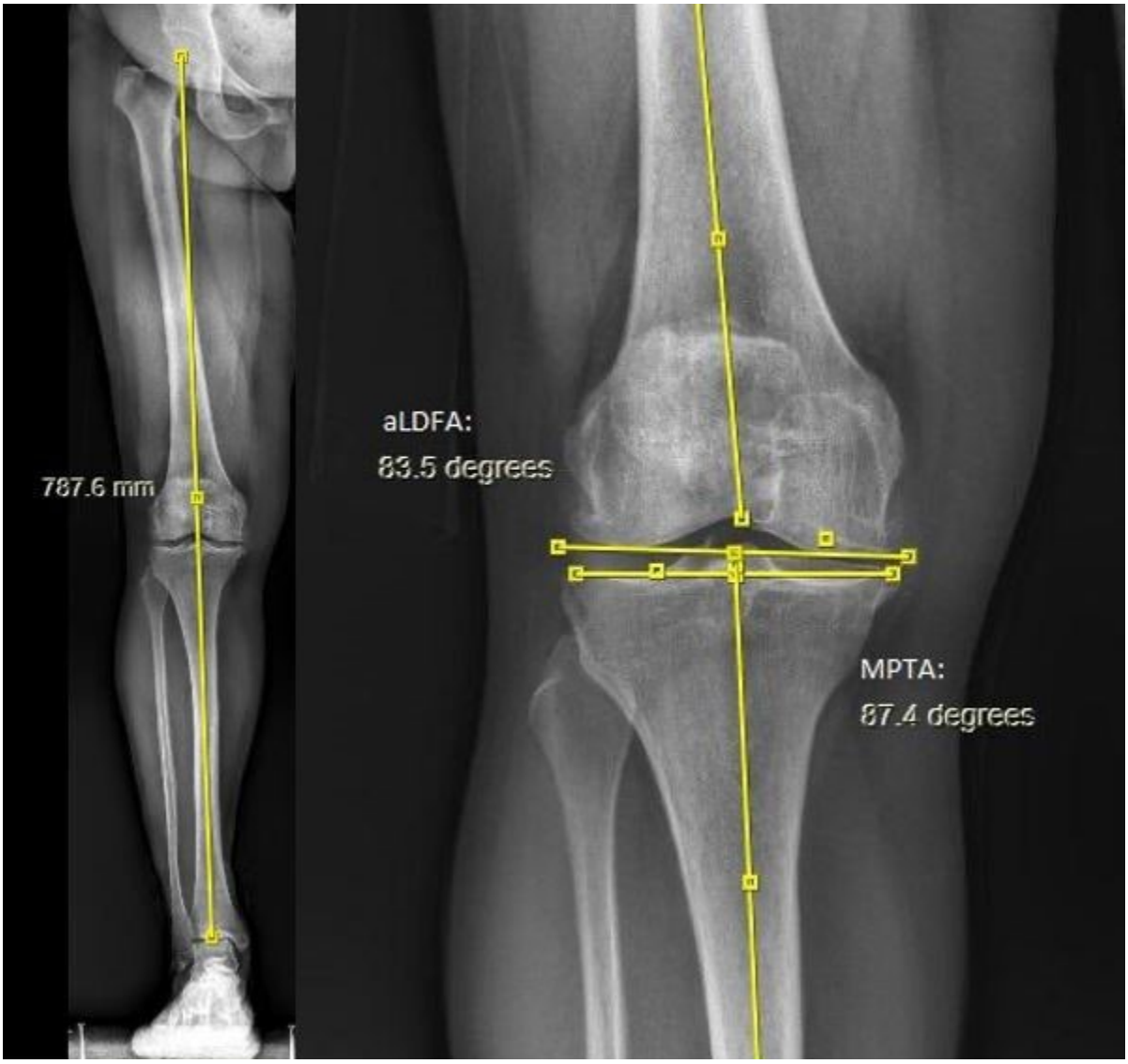
DOI: 10.7547/22-080

Journal of the American Podiatric Medical Association

Figure 3: Lower extremity deformity analysis evaluated as normal



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DOI: 10.7547/22-080

Journal of the American Podiatric Medical Association

Figure 4: Peripheral MR Neurography scan shows that there are no pathologies such as impingement and edema along the peroneal nerve trace. Deep peroneal nerve indicated by yellow arrow and posterior tibial nerve indicated by green arrow.

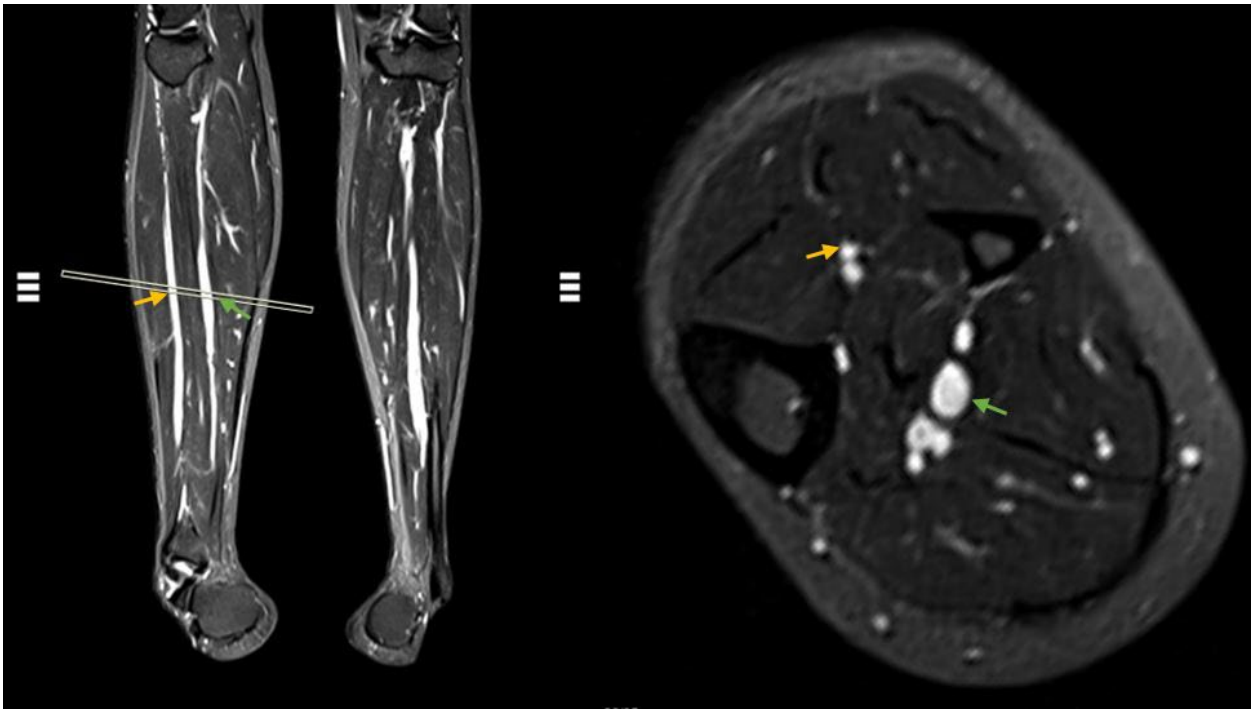

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Figure 5: Cranial MRI scan evaluated as normal