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Case Report

Where is your smartphone? An unusual mass within the tensor fasciae latae muscle ☆

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ABSTRACT

We report a case of a 40-year-old Italian man presenting with an intramuscular schwannoma in his left thigh, which coincided with the area where he habitually stored his smartphone (front left trouser pocket). An ultrasound examination revealed a well-defined, encapsulated, hypoechoic lesion (41 × 15 × 28 mm) within the muscle, showing multiple small foci of vascularity on color Doppler. Elastographic analysis indicated a deformability score of 2, with some areas of stiffness. Magnetic resonance imaging confirmed the presence of a spindle-shaped mass in the tensor fasciae latae muscle, with varying enhancement after contrast administration. Notably, the location of the intramuscular mass closely corresponded to the placement of the phone's SIM card. While we cannot establish a definitive causal relationship between the patient's smartphone storage habit and the development of the intramuscular schwannoma, we speculate that the habitual storage location may have potentially acted as a risk or predisposing factor. This case underscores the need for further research on the potential health risks associated with smartphone storage habits, considering their widespread prevalence in today's society.

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Background

Intramuscular schwannomas are benign neurogenic tumors that originate from Schwann cells, which are responsible for the formation of peripheral nervous system myelin. These lesions account for only 5% of all benign soft tissue neoplasms [1]. Typically, intramuscular schwannomas present as slow-growing, painless masses that are clearly demarcated and often remain asymptomatic until they grow large enough to exert pressure on adjacent tissues [1,2]. Due to their infrequency, diagnosing these tumors can be challenging. However, magnetic resonance imaging (MRI) is a valuable tool for distinguishing intramuscular schwannomas from other tumor types, while a biopsy can conclusively confirm the diagnosis [1,2]. The origin and progression of schwannomas are

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facets under constant and evolving investigation [3]. Among the various factors that have been studied, consistent exposure to radiofrequency radiation (RFR) emitted by mobile phones is 1 environmental factor that has been suggested to potentially influence their development [4–6]. After the International Agency for Research on Cancer classified RFR from mobile phones as a "possible" human carcinogen (Group 2B) in 2011, several epidemiological studies have investigated the potential link between the risk of nonmalignant tumors, such as cranial vestibular schwannomas, and heavy mobile phone use, especially among individuals who consistently use their device on the same side of the head [7]. Although the findings remain controversial, there is also evidence indicating that men who regularly carry their mobile phones in their trouser pockets or on belts near the testes may experience a decline in sperm quality [8,9]. However, to date, there have been no studies suggesting a possible correlation between carrying a smartphone in a trouser pocket and an increased risk of developing intramuscular tumors, including schwannomas. Here, we describe a case where a schwannoma occurred in the tensor fasciae latae muscle of a man who habitually kept his smartphone in his front left trouser pocket.

Case report

A 40-year-old Italian man presented for evaluation of a painless mass that had been gradually expanding in the proximal third of his anterolateral left thigh for a period of 6 months. His medical history was unremarkable. Upon careful medical examination, the mass was found to be firm, nontender under pressure, and seemingly embedded within the muscular tissue of the thigh. The lesion was devoid of any noticeable inflammation, and the patient did not exhibit or report any changes in motor or sensory functions. An ultrasound scan revealed a well-defined, encapsulated, intramuscular hypoechoic lesion (dimensions: 41 × 15 × 28 mm), with multiple small foci of vascularity on color Doppler (Fig. 1). The mass had an elastographic score of 2, indicating deformability of most of the lesion with small stiff areas (Fig. 2). Subsequent MRI highlighted a spindle-shaped mass with clear boundaries, nestled within the tensor fasciae latae muscle (Fig. 3). The lesion displayed heterogeneous enhancement following the administration of a contrast agent. The radiological appearance was consistent with an intramuscular schwannoma. The diagnosis was later confirmed through an incisional biopsy conducted at a different private healthcare facility. The results revealed the presence of fibroconnective tissue, sparsely populated with spindle cells, embedded in a myxoid stroma. In an effort to identify potential risk factors that may have predisposed our patient to schwannoma development, we conducted a comprehensive review of his medical history. He reported no history of neurofibromatosis type 2 (NF2), local trauma, local exposure to ionizing radiation, or atopic diseases. Unfortunately, genetic testing for mutations in the *NF2* gene was not performed. Given the tumor's location and prior research suggesting that schwannomas may develop in areas absorbing energy from mobile phone use, we also investigated his habitual smartphone storage habits. Notably, the patient

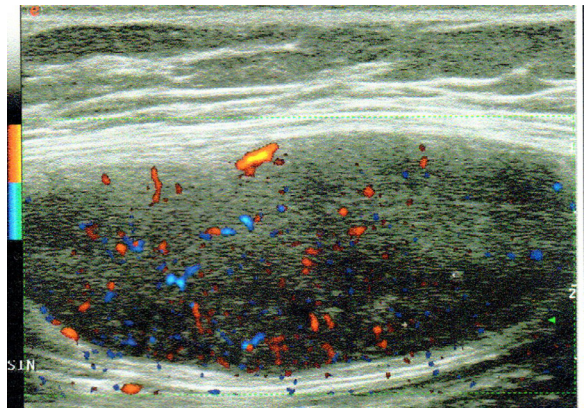


Fig. 1 – Color Doppler imaging revealed multiple small foci of vascularity scattered within a clearly defined, well-encapsulated, hypoechoic lesion located in the left thigh's muscle.

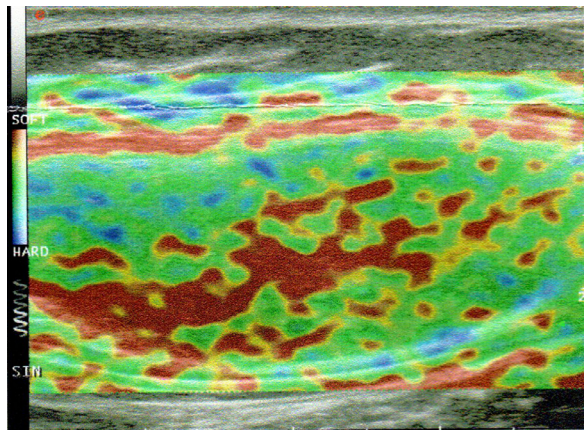


Fig. 2 – The mass exhibited a slightly rigid texture and appeared predominantly green, with some areas displaying a blue hue. These findings correspond to an elastographic score of 2, indicating that the majority of the lesion was deformable, with a few small regions of stiffness.

revealed that for the past decade, he consistently kept his 3-4G smartphone in his front left trouser pocket, which intriguingly aligns with the intramuscular mass's location and the phone's SIM card position. The patient stated that he usually kept his smartphone in his pocket for approximately 8 hours each day. During this period, the WiFi module of the phone remained deactivated, and only the SIM card was active. Consequently, all data traffic, including incoming emails, messages, social media notifications, and inbound calls, were handled solely by the SIM card while the phone was stored in his pocket. Due to the tumor's location within the muscle and its potential impact on the surrounding nerves, he opted against surgical removal. Currently, the tumor's progression is being vigilantly tracked every 6 months using ultrasound. Following a year of monitoring, the mass has shown no substantial growth, suggesting a stable condition. To mitigate further exposure to RFR

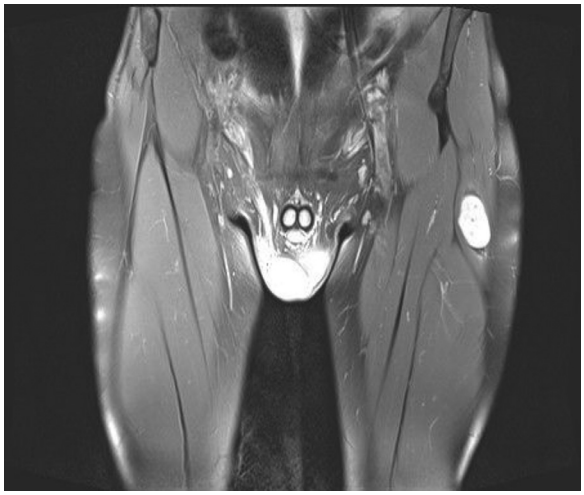


Fig. 3 – Magnetic resonance imaging (proton density-weighted fat suppression fast spin echo sequence, coronal view) revealed a spindle-shaped mass with well-defined edges situated within the tensor fasciae latae muscle.

at the lesion site, the patient was counseled to contemplate alternate methods of phone storage.

Discussion

Previous studies, featuring both epidemiological [4–6] and experimental [10] approaches, have provided evidence suggesting a potential link between RFR emitted by mobile phones and the development of schwannomas. Notably, regions that experience higher absorption of energy from mobile phone usage have shown an increased propensity for vestibular schwannomas [6]. Additionally, a comprehensive animal study demonstrated a significant increase in the incidence of heart schwannomas among male rats exposed to elevated RFR levels (50 V/m) [10]. In this report, we present an intriguing case of intramuscular schwannoma that developed within the tensor fasciae latae muscle. This occurrence showed a potential correlation with a decade-long habit of keeping a smartphone in the front left trouser pocket. While we cannot conclusively link the patient's intramuscular schwannoma to his practice of storing his smartphone in that specific location, we hypothesize that this habitual placement could potentially have served as a risk or contributing factor. It is interesting to observe that the tumor emerged in a region that closely corresponded to the location of the smartphone's SIM card – a component which is able to emit RFR. A radio frequency SIM card typically includes an antenna and a contactless front-end chip, which contains a radio frequency radiating circuit [11]. The radiating power of RFR circuits is typically adjusted to the maximum to ensure optimal wireless communication performance.

This case study lends further credence to the idea that storing smartphones in trouser pockets could potentially have detrimental health effects. These implications go beyond the apparent reduction of sperm quality in men [8,9] and hint, for the first time, towards a possible risk or contributory factor in the development of intramuscular schwannoma. While we cannot definitively establish a causal link, increasing public awareness about the significance of safe smartphone storage habits could be beneficial, and this topic is beginning to garner attention [12]. Through advocating for the practice of carrying phones in bags rather than pockets, we might potentially mitigate the alleged health risks associated with keeping devices in close proximity to the body.

The prognosis for patients diagnosed with intramuscular schwannoma is generally positive [1]. However, the absence of universally accepted clinical practice guidelines makes it challenging to determine the best management and follow-up strategies. To make informed decisions, healthcare providers must consider various factors, such as clinical symptoms, tumor size, location, and histopathological results, when choosing between active monitoring or surgical removal. Tailoring the approach to each patient's unique circumstances is crucial for optimal care. Performing surgery requires meticulous execution to maintain the functionality of the affected nerves. However, surgical resection can be challenging due to the intramuscular location of the tumor and the possibility of nearby nerve involvement [1,2]. In cases where the tumor is asymptomatic and well encapsulated, like our patient, regular monitoring through imaging studies may be a viable strategy. This approach allows for the continuous assessment of the tumor's growth, while avoiding the complexities associated with surgical intervention.

Conclusion

In a recent study, it was found that over 75% of participants carried their phones in their skirts or trouser pockets, which means the phones were in close proximity to their bodies and continued to transmit RFR [12]. While a general perception of risk associated with RFR exposure was not reported, it was evident that many people had concerns about carrying a smartphone against their bodies, despite it being a common behavior [12]. This case report presents initial evidence suggesting that prolonged exposure to RFR from carrying a smartphone in a trouser pocket could potentially contribute to the development of intramuscular schwannoma. This hypothesis has implications for public health, considering the widespread use of smartphones in modern societies. Although the correlation is currently speculative and requires further empirical validation, it is of utmost importance to investigate smartphone carrying habits and explore potential associations with neoplasms or other health issues related to RFR [12].

Author's contributions

PM and EE: Case file retrieval case and preparation of manuscript. AL: critical revision for important intellectual content and manuscript editing. All authors read and approved the final manuscript.

Availability of data and materials

Data and materials used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval

Our institutions do not require ethical approval for reporting individual cases.

Patient consent

Written informed consent for patient information to be published in this article was obtained. Data and materials used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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