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Editorial

Artificial Intelligence in Medicine: Physician Knowledge, Professional Challenges, and Job Displacement

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Artificial Intelligence (AI) is revolutionizing the healthcare sector more rapidly than ever, promising to improve patient experiences, enhance diagnostic precision, and refine treatment strategies. However, these innovations bring about significant challenges for medical professionals. The incorporation of AI into healthcare is set to transform the functions of healthcare providers, change the nature of the doctor-patient interaction, and create various ethical and legal dilemmas. In this article, we will discuss the primary professional hurdles doctors may encounter in the future due to AI-enhanced medical practices.

A central concern for physicians is the risk of obsolescence of traditional medical roles. AI-based diagnostic systems, robotic surgeries, and automated treatment protocols could lessen the need for certain specialties and undermine the decision-making authority of human practitioners. Radiologists, pathologists, and general practitioners may see job prospects diminish as AI technologies surpass them in pattern recognition and data processing. Additionally, doctors' roles may transition from primary decision-makers to overseers of AI functions. This shift could lead to decreased job satisfaction, diminished autonomy, and a reduction of the traditional esteem tied to the medical profession. In the following sections, we summarize the projected impact of AI on the specialties that will be significantly affected.

Radiology is among the medical fields most vulnerable to AI disruption. AI algorithms can evaluate imaging scans like X-rays, MRIs, and CT scans with impressive accuracy, often equaling or exceeding the capabilities of human radiologists in identifying abnormalities. Tools utilizing deep learning models have been successfully employed to detect tumors, fractures, and other medical concerns, potentially lessening human involvement in standard cases. Although AI is unlikely to fully replace radiologists, the number of practitioners needed in the field may decline as AI handles initial evaluations and basic diagnostic roles.

Pathology encompasses the microscopic assessment of tissues and cells for disease diagnosis. AI-fueled tools can analyze histopathological slides more efficiently and accurately than humans, detecting cancerous cells and other disorders with high precision. Such systems can also standardize diagnostic processes, minimizing variability among pathologists. With the potential for AI to automate many aspects of pathology, there may be a decreased need for human pathologists. Nevertheless, pathologists will remain essential for intricate cases and for validating AI-generated findings.

In dermatology, AI has proven remarkably effective in recognizing skin disorders, including melanoma and other skin cancers, through image recognition technology. AI-based mobile applications can now analyze skin lesions and offer initial assessments, potentially decreasing the demand for dermatologists in routine diagnoses. While the need for dermatologists to assess common skin ailments may decrease, their expertise will continue to be vital for in-person interventions, biopsies, and challenging cases requiring human judgment.

In the field of ophthalmology, AI advancements have significantly improved the detection of eye disorders such as diabetic retinopathy, glaucoma, and macular degeneration. AI-assisted retinal imaging tools can swiftly and accurately screen patients, potentially lessening the demand for human ophthalmologists in routine diagnostics. Although AI might lower the demand for

ophthalmologists in standard screenings and early detection, human specialists will still be indispensable for surgical treatments, advanced care, and patient management.

Anesthesiology, which involves monitoring patients during surgical procedures and administering anesthesia, may also see changes. AI systems capable of autonomously managing drug administration and patient monitoring could decrease the necessity for human involvement in certain procedures. Although anesthesiologists will still be essential for complex surgeries, AI automation might result in fewer professionals being required for routine cases, especially those that are low-risk or outpatient.

In general practice and primary care, AI-powered chatbots and virtual healthcare assistants are becoming increasingly proficient at handling initial consultations, diagnosing common ailments, and dispensing medical advice. These systems can effectively triage patients and refer them to specialists when adequate. As a result, AI-driven primary care solutions could lessen the demand for general practitioners (GPs), particularly for minor issues and routine check-ups. However, human doctors will still be critical for meaningful patient interactions, comprehensive care, and managing complex medical situations.

In cardiology, AI is being deployed to detect cardiovascular diseases, evaluate heart attack risks, and analyze ECG patterns with high accuracy. AI technologies can assist in interpreting echocardiograms and identifying abnormalities that human cardiologists might overlook. Although AI may diminish the need for cardiologists in screenings and diagnostic assessments, human specialists will remain essential for treatment planning, interventional procedures, and overall patient care management.

In emergency medicine, AI-fueled systems are being utilized to aid in triaging emergency cases, forecasting patient deterioration, and optimizing hospital resource deployment. AI diagnostic tools in emergency settings can rapidly recognize conditions like strokes or sepsis, facilitating quicker treatment decisions. While AI has the potential to enhance the efficiency of emergency medicine workflows, human input will continue to be crucial for crisis management, surgical procedures, and direct patient care.

In Psychiatry the integration of AI in mental health care is growing through the use of chatbots, virtual therapists, and predictive analytics that evaluate patients' emotional states and mental health issues. AI-powered therapy applications are capable of delivering cognitive behavioral therapy (CBT) and additional support to individuals. While AI could diminish the reliance on human psychiatrists for standard therapy sessions and initial evaluations, human insights will remain crucial for addressing complex psychiatric conditions, managing medications, and ensuring personalized interactions with patients.

AI is also affects surgery. Advancements in robotic-assisted surgery and AI-informed surgical planning have led to greater precision and improved outcomes across numerous surgical disciplines. AI-enhanced robotic technologies are capable of executing minimally invasive surgeries with remarkable accuracy, which may lessen the necessity for human surgeons in certain procedures. Nonetheless, human expertise will be indispensable for complex cases, crucial decision-making, and managing unforeseen complications during surgery.

AI is poised to transform healthcare by automating diagnostic functions, boosting efficiency, and improving patient care outcomes. However, its broad adoption raises significant concerns regarding job stability in various medical fields. Although AI is unlikely to completely replace doctors, it will certainly alter the workforce dynamics, lowering the demand for some roles while generating new opportunities in AI oversight and healthcare technology management. To counteract potential job loss, medical professionals should prioritize continuous education, cultivate competencies related to AI, and adjust to the evolving healthcare landscape. By viewing AI as a partner rather than a substitute, doctors can secure

their vital role in the future of healthcare.

The rising reliance on AI in medicine brings forth numerous ethical and legal dilemmas. Who takes responsibility when an AI system misdiagnoses a condition or prescribes an inappropriate treatment? Currently, physicians face malpractice liability, but AI-induced mistakes introduce a new challenge in establishing accountability for errors. Moreover, AI systems depend heavily on extensive datasets generally obtained from electronic health records. This reliance raises urgent issues around patient privacy and data security, as vulnerabilities or biases within AI algorithms could lead to harmful impacts. Physicians will face complicated legal challenges and will need to champion transparent regulations concerning AI's role in healthcare.

As AI technologies become more skilled at detecting diseases and proposing treatments, there exists a risk that physicians might overly depend on such systems. Such dependency may result in skill erosion, wherein doctors lose their capacity to analyze cases independently and make informed clinical choices. Eventually, a generation of physicians may emerge who lack the critical abilities necessary to work without AI assistance. Furthermore, AI is not without flaws. Errors can occur due to biased training sets, software issues, or unexpected medical scenarios absent from its data bank. If healthcare practitioners neglect their fundamental diagnostic skills, they may find it challenging to identify and correct AI-related mistakes, potentially leading to severe ramifications for patient care.

The doctor-patient relationship has traditionally been rooted in trust, empathy, and communication. AI-assisted healthcare solutions, including virtual consultations and automated diagnostics, could undermine this essential human component. While AI's capability to process vast amounts of medical information is undeniable, it cannot replicate the emotional intelligence and warmth that professionals provide. Patients may experience discomfort or alienation when interacting with AI-driven systems, especially in sensitive scenarios such as terminal illnesses or mental health concerns. Future healthcare providers will face the task of merging AI technology with maintaining the crucial personal rapport that is vital for effective medical care.

AI integration in medicine compels doctors to constantly refresh their skills and adapt to ever-evolving technologies. Medical professionals are tasked not only with keeping pace with advancements in their specialty but also with acquiring new competencies relating to AI literacy, data analysis, and technology management. This ongoing educational demand can feel daunting, particularly for seasoned practitioners grappling with the shift from traditional to AI-enabled workflows.

To prepare upcoming doctors for a technology-centric healthcare environment, medical schools and training programs must weave AI education into their curricula. However, maintaining a balance between AI expertise and conventional medical training poses a challenge that educational institutions must address. AI systems' effectiveness hinges on the quality of the data they're taught with. If training data is biased or incomplete, AI applications can perpetuate current inequalities. For instance, an AI diagnostic tool trained primarily on data from Western populations risks lacking accuracy when used with non-Western patients. Physicians must remain alert to biases in AI technologies, advocate for inclusive and representative datasets, and work towards equitable healthcare results for all populations.

The implementation of AI in healthcare might result in financial and operational dilemmas for doctors. Although AI could lower healthcare expenses over time, the initial rollout of these technologies demands substantial investment. Hospitals and private practices might focus on cost-reduction, resulting in job losses, wage cuts, or heavier duties for remaining staff. Additionally, AI-driven healthcare models might place increased power in the hands of corporate entities and tech companies, potentially influencing medical decision-making. Physicians could find themselves in situations where AI dictates clinical practices,

limiting their autonomy over medical judgments.

The medical field has traditionally been characterized by rigorous education, expertise, and direct patient interactions. The advent of AI may challenge these established identities, compelling doctors to reconsider their roles in healthcare. Many practitioners may resist these AI-driven transformations, driven by fears of being rendered obsolete, skepticism towards technology, or uncertainty regarding their profession's future. To overcome this, healthcare organizations need to cultivate a collaborative environment between physicians and AI developers. Rather than perceiving AI as a threat, doctors should be guided to view it as an enhancing tool that ultimately benefits patient care.

The incorporation of AI into medicine presents both prospects and challenges for doctors. While AI possesses the potential to overhaul healthcare by boosting efficiency, precision, and availability, it also introduces considerable professional challenges. Issues such as job displacement, ethical conundrums, skills attrition, loss of personal interaction, ongoing educational expectations, bias, economic hurdles, and resistance to change will be central concerns for healthcare practitioners in the years ahead. To ensure AI supports rather than undermines the medical profession, doctors must take proactive roles in shaping AI policies, advocating for ethical practices, and embracing ongoing education. The future of medicine will hinge on doctors' ability to adapt to and incorporate AI while upholding the foundational principles of patient care, empathy, and professional integrity.

Numerous studies have explored physicians' understanding and awareness of AI in clinical contexts. A cross-sectional investigation published in *Advances in Medical Education and Practice* assessed healthcare professionals' knowledge, attitudes, and practices relating to AI. The findings revealed that while there is a general awareness of AI technologies, there remains a significant gap in in-depth knowledge and practical application among physicians. Many participants acknowledged AI's potential to transform healthcare, yet admitted to insufficient understanding to effectively utilize AI tools in their practices.

The degree of AI integration into daily medical routines varies among physicians. A survey reported by *The Guardian* indicated that about one in five general practitioners (GPs) has employed AI tools, including ChatGPT, for tasks such as drafting patient letters and suggesting alternative diagnoses. Specifically, 29% of GPs using AI relied on it for documentation, while 28% utilized it for exploring differential diagnoses. Even with this level of use, the survey suggests that a significant minority of physicians remain hesitant or underprepared to fully adopt AI technologies in their practices.

Trust in AI-generated outputs profoundly influences physicians' willingness to adopt these tools. A study published in *JAMA Network Open* evaluated the reliability of AI-generated chatbot responses to medical inquiries from healthcare providers across various specialties. The results indicated that, while AI can deliver accurate information, there is inconsistency in its reliability. Physicians expressed apprehensions about the accuracy of AI-generated content, reiterating the necessity for human oversight in clinical decision-making processes.

Recognizing the potential hazards of AI in healthcare is crucial for its responsible integration. A recent article in JAMA Health Forum highlighted the liability concerns tied to the use of generative AI in the medical field. The discussion pointed out that although AI presents exciting advantages, it also brings forth issues related to patient safety, data confidentiality, and ethical dilemmas. Healthcare professionals must be aware of these dangers to navigate the complexities of AI deployment wisely. Conversations about AI in medicine often show diverse levels of understanding among physicians. Some partake in meaningful debates, acknowledging both the strengths and shortcomings of AI, while others may mention AI without fully comprehending its ramifications. This variation underscores the necessity for thorough educational and training programs to empower physicians with the expertise needed to critically

evaluate and utilize AI technologies effectively.

The incorporation of AI into healthcare offers both significant advantages and notable challenges. Current findings suggest that while physicians generally recognize AI, there are considerable gaps in nuanced knowledge, practical use, and awareness of related risks. To address these disparities, it is essential to introduce specialized educational efforts, establish clear protocols, and promote an atmosphere that supports informed dialogue about AI in medicine. Through these actions, the medical community can leverage the benefits of AI to improve patient care while reducing potential risks.

Historical Vignette

Byzantine suggestions and treatment on gout by Ioannis Komnenos Choumnos (1290-1338)

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Abstract

This paper explores the insights of Ioannis Komnenos Choumnos (1290-1338), a Byzantine scholar, on gout management. Choumnos, combining his expertise in philosophy and medicine, emphasizes a holistic approach to preventing and treating gout. He advises avoiding foods like salty, smoked, and acidic items, dairy products, and excessive alcohol, recommending instead a diet of easily digestible foods and moderate exercise, such as walking and horseback riding. Choumnos also stresses the importance of regular bathing and overall hygiene. His philosophy of moderation underpins his advice, warning against overindulgence in food and drink, which he views as detrimental to health. While his recommendations resonate with modern practices, the historical reliance on wine due to unsafe water highlights unique challenges during the medieval times. Choumnos's work offers timeless guidance on the impact of lifestyle choices on health and disease prevention.

Keywords: gout, statesman, philosophy, ethics, diet, podagra

Introduction

Ioannis Komnenos Choumnos (Greek: Ιωάννης Κομνηνός Χούμνος) was a Byzantine general, scholar, and statesman who lived from 1290 to 1338. As the eldest son of Nikephoros Choumnos (ca 1250/1255-1327), himself a noted scholar and statesman, John was significantly influenced by his father's intellectual and political legacy. He quickly rose in the imperial hierarchy and was named "Parakoimomenos tou Koitonos" (a high-ranking court title). Ioannis Choumnos led the Byzantine forces against the Ottomans in Bithynia from 1300 to 1306, under the command of Michael IX Palaiologos (1277-1320). As a result, he gained a reputation for his military abilities and in 1307, was promoted to «Parakoimomenos tes Sphendones». Komnenos was a cultured man, having studied rhetoric, philosophy and medicine and his letters were preserved in historical manuscripts [1-2].

In ancient Greek medicine gout was called ''ποδάγρα'' (podagra) [Figure 1] from the words "pous" meaning a foot and "agra'': a seizure, to refer to the lesions involving the first metatarsophalangeal joint of the big toe followed by the other joints of the feet and later on of the hands [3]. Dominican monk Randolphus of Bocking (1197-1258) reinstated the name of gout as podagra eons later [4]. This historical vignette surveys the saved work of Ioannis Choumnos related to gout (Greek: ποδάγρα, podagra), unveiling some neglected philosophical and medical aspects on the matter.

Addressing gout management. In his eighth letter titled ''Prophylactic diet for gout'' - ("Δίαιτα προφυλακτική εἰς ποδάγραν") he focuses on the prevention of gout, analyzing three main points: proper diet, exercise and maintaining hygiene [5]. His work on proper diet for gout is significant as a medical treatise. The excerpt is as follows:

Figure 1. Venus, Podagra and Bacchus, engraving by Johann Andreas Schlegel (ca 1657-1681), in Scriptum apologetico-politicum de podagra, Joh. Brühl, Weisenfels, 1687, representing gout as a man with an inflicted right foot and hand

“Βρώματα ταριχευτά πάντα, κάν οποῖά ποτ’ ἀν εἴη και όπως ἐσκευασμένα, καθάπαξ φύλασσου, ὡσαύτως δη και δριμέα. Γάλα παν, και ὅσα πηγνυμένου τοῦ γάλακτος ειδιοποιεῖται, φυγῆ φεῦγε. Μὴ δίωκε ἰχθῦς ἐκ τηγάνου, ἤ άλλ’ άττα.

Τῶν ωῶν πάντων ἄπεχου. Ἄρτου μὴ ἐμφοροῦ. Εδηδοκώς, σκόπει μὴ ὑπερκορής γίγνη. Μὴ κενωθέντος σοι τοῦ στομάχου ὡστ’ ἐπιεικῶς ζητεῖν τροφήν, μὴ ποτε προσενέγκῃς. Μὴ χαῖρε ταῖς τῶν ὀψων ποικιλίαις ἤ καρυκείας. Ζήλου δὲ μᾶλλον τοὺς ἁπλοῖς βρώμασιν ἐφθοῖς καὶ ὀπτοῖς τερεφομένους. Λάχανα πάντα και ὅσα γε μὴν ἕτερα μὴ δεχομένων σοι τῶν σπλάγχνων, διά τὸ μὴ ἐρρῶσθαι, μηδέ τῷ στόματι δέχου. Σησαμοῦντας, ὡς σηπεδόνας αἵματος, τοῖς γαστριζομένοις χαρίζου, ἔτι γε μὴν καὶ τοὺς ἄρτους, ὅσοι μὴ ἐξ ἀλεύρου, ἀλλ’ ἐρεβίνθων, τήν ζύμην τυγχάνουσι κεκτημένοι. Οἴνῳ ἀκράτῳ μὴ χρῶ, μήτε μὴν νικῶντι τὸ ὕδωρ, ἀλλ’ ὑπ’ αὐτοῦ νικωμένῳ. Μὴ παραρρύῃς υπό δίψους, πέψεως γιγνομένης, εἰς πολυποσίαν, ὅπερ δῆτ’ ἐπηπείλησέ σοι, ἵν’ ὑφορώμενος νόσον, ταῦτα γράφεις. Ὕδατά σε λίαν ψυχρά μὴ ἐπισπάσητα, ὥρα θέρους, πολλοῦ γε δέω φάναι, χειμῶνος μὴδ’ ἐντρέπου βρωμάτων οὕτως ἐχόντων, μηδέ τούνατίον ὑπερζεόντων. Τὸ ήδύ τῶν ὁπωρῶν εἰ μή πασῶν τελέως διαδρᾶναί γε δυνηθείης, δίδου τινῶν ἐγκρατῶς σεαυτῶ τάς πλείστας δὲ τούτων ὡς μή οὔσας ἀποστρέφου, ὅσαι γε μὴν ὑγρότεραι καὶ ψυχρότεραι καθεστᾶται. Πέμμασι τὸν νοῦν μὴ προσέχειν. Μήτε βαλάνους φοινίκων ἤ ἀκρόδρυ’ ἄττα περιποιῦ. Μήδ’ ἐξαπατάτω, μηδὲ παρασυρέτω σε ταῦται τῇ γαστρί χαρίζεσθαι. Μηδέ ζήτει φαγών τραγήματα, κλεπτομένος ὑφ’ ἡδονῆς τούτων, ἄλλην αὖθις τροφὴν οὐκ ἀναγκαίαν οὐδέ κατάλληλόν σοι. Τῶν σιτίων ἅπερ ἐδηδόκεις μὴ πεφθέντων, μη ποτ’ ἀφροδίσιων ἥττηθῆς: ἀλλὰ καὶ οὕτω σαυτὸν τούτοις μὴ κατατείνης. Τα τήμερον βρωθέντα σοι και πεφθέντα αὔριον ἐξ ἐωθινοῦ ἐκκριθῆναι πρᾶξον, καὶ τοῦτ’ ἀεὶ ποίει.

Πρόσκεισο γυμνασίοις· γυμνάζου δ’ οὖχ ἥκιστα περιπάτοις ἤ ἱππασία. Θεράπευε σεαυτὸν λουτροῖς δίς ἡ ἅπαξ τοῦ μηνός. Τέμνου φλέβα ὁπόταν καὶ ὁποίαν ἂν οἱ Ἀσκληπιάδαι προστάξαιεν. Ἂν οὕτως γε σαυτὸν διαιτῳης, δυνήση, προγονικῆς ἴσως ἐπισειομένης σοι νόσου, ὑπέρτερος γενέσθαι, αὐτοῦ συναιρομένου τοῦ κρείττονος. Εἰ δὲ σε, ὡς ἀντ’ ἄλλον παπρῳου κλήρον ὸν ἔδει σοι περιγενθέσθαι ὡς πρωτοτόκω, ταύτην γε μὴν εἴμαρτα δῆτ’ ἐπανιμηκέναι, ἀλλ’ οὖν ῥᾷον οἴσεις μετα τοιαύτης δίαιτης.

Ἂν δὲ κατὰ μῆνιν Θεοῦ ὑπέρσχη, οὔτε σύ σαυτὸν, οὔτ’ ἄλλος αἰτιάσεταί σε, ὡς βρωμάτων ἡττηθέντα μοχθηροτέρων τοῦτο παθόντα, καὶ ὑπ’ ὀρέξεως ἐνσχεθέντα τοσαύταις ἀφύκτοις παγῖσι. Καὶ γὰρ οἱ διὰ ταῦτα τούτῳ τῳ πάθει ἐνισχημένοι ἔοίκασί μοι καὶ τῆς μελλούσης κολάσεως ἀλογεῖν.

Ὁ γὰρ διά βρώμαθ ἑαυτὸν εἰς τοιαύτας περιωδυνίας καὶ ἀλγηδόνας ἐνσείων και, τὸ τῆς παροιμίας, ὸν καταβάλλεται καρπὸν θερίζων, καὶ οὐκ ἀφιστάμενους τούτων, προδήλου ὄντος τοῦ αἰτίου, καὶ παρά πόδας

καὶ ἐξ ὑπογυίου τίσεως, σχολῇ γ' ἂν ὄγε τοιοῦτος τὰς ἀπειρημένας ἡδονὰς ἀποσκορακίσοι διὰ τὴν μὴ φαινομένην μέλλουσαν τίσιν.''[5].

1. do not eat everytome you are hungry
2. avoid spices
3. ρεβυθοψωμο
4. mediocrity fruits
5. blood letting in which vein needed

In this letter he recommends avoiding salt preserved foods, milk and spices. He also advocated to refrain from the consumption of fried foods, especially fish and eggs. Instead of normal bread he encourages the consumption of chickpea bread. He emphasizes that the consumption of wine should be done in moderation and with the addition of water, as was customary at ancient and to a lesser extent Byzantine times [6]. Also special preference is shown for boiled vegetables and easily digestible products. Furthermore, he refers to the practice of bloodletting to whichever vein the doctors (Asclepiads) seem fit, as this was an ancient practice for the treatment of several diseases. [7]

Choumnos also places a strong emphasis on lifestyle, advocating for regular physical activity, such as walking and horseback riding, to maintain physical health as was popular at the time [8]. Additionally, his advice on hygiene, specifically bathing once or twice a month, notes the importance of hygiene in a general healthy perspective. Most of his suggestions could be applied in contemporary times for management and treatment of podagra, but compared to today's standards consuming wine is strongly discouraged. It is understandable that at that time, wine had a more widespread use and in some cases substituted a significant part of water consumption. This was due to the difficulty in gathering safe water and the many diseases that followed from drinking contaminated water. In contrast, wine consumption was more popular than it is today, as it was commonly used in church masses, which were much more influential and widely attended at the time. Additionally, wine presented fewer risks of infection compared to water [9].

In his sixth letter named "ΤΩ ΦΙΛΟΣΟΦΩ." (to the philosopher), he describes a drinking scene. Specifically, he mentions the following:

"ὑπισχνεῖσθαι πιεῖν, καὶ παραπαίουσι, καὶ ὀρθοεπεῖν οὐ δεδύνηνται, καὶ ἐπεγγελώντων ἄλλων καὶ αὐτοὶ ἐπεγγελῶσιν. αὐτοῖς, καὶ, πειρώμενοι ἀνίστασθαι, καταπίπτουσι, καὶ βαδίζειν ἐπιχειροῦντες, διολισθαίνουσι, καὶ κλονοῦνται τρομερῶν αὐτῶν τῶν γονάτων ὑπ' ἀκράτου καθισταμένων, και βοῶσιν ἄσημα καὶ ἀλλόκοτα, καὶ μεμηνόσιν ἐοίκασιν ἀτεχνῶς. γὰρ πόσις οὐ μέχρι κόρου, ἀλλ' ἄχρις ἐμέτου καὶ καταπτώσεως ἀναισθήτου. Καὶ τούτων πάντων τῶν κακῶν, οἷς ὑπ' οἴνου ἐνίσχηνται, μία λύσις, ὕπνος, καὶ οὗτος θανάτου μικρὸν διενηνοχώς. "[10]

He describes the consequences of excessive drinking, painting a picture of moral and physical degeneration. He illustrates a scene where individuals, having pledged to drink, find themselves unable to maintain their composure. They stagger, unable to stand upright and laugh along with others. Their attempts to rise end in failure as they collapse, and their efforts to walk end up in failure. Choumnos notes that the situation resembles madness in its most raw form. He describes this behavior as a result of drinking not to the point of satisfaction, but to the extreme of vomiting and senseless collapse. He depicts this state in a degenerative manner and concludes that the only remedy for these ills brought on by wine is sleep, a sleep that closely resembles death in its profound stillness. Choumnos's portrayal of this scene serves as a warning against the dangers of abandoning moderation.

Conclusion

Choumnos died sometime between 1332 and 1338, while serving as governor of Chios [9]. Although Choumnos' opinions on gout

present some scientific interest, researchers reviewing the subject are neglecting to mention him [11], while Byzantine literature dedicated small fragments, categorizing him as an ecclesiastical figure [12]. This may be due to the fact that Choumnos prescribed a strict diet, eliminating salted and smoked foods, fried fish, eggs, milk and dairy products, following through and repeating Demetrius Pepagomenus' (1200-1300) recommendations for the prevention of gout [13].

Ioannis Komnenos Choumnos's contributions to the understanding and management of gout, as well as his observations on the consequences of excessive drinking, are a significant addition to byzantine medicine. His beliefs, rooted in moderation and preventive care, emphasize the importance of a balanced diet, regular exercise, and hygiene—principles that remain relevant in contemporary medical practice. Choumnos's depiction of the degeneration caused by excessive drinking serves as a philosophical approach in moderation along with his other works and was dictated by Christian Eastern Roman ethics. His approach on gout also aligned with earlier scholars like Demetrius Pepagomenus and in part he repeated his work on gout. Nevertheless, his writings provide valuable insights into Byzantine medical practices and the enduring continuation of medical knowledge.

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Case Report

Thrombosis of the Persistent Median Artery presenting as acute Carpal Tunnel Syndrome: A Case Report and Literature Review

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Abstract

We present a case of a 40-year-old female with bifid median nerve and a persistent median artery (PMA) who presented with typical symptoms of carpal tunnel syndrome (CTS). Ultrasound (US) revealed the anatomical variation and the presence of thrombosis of the PMA as the cause of symptoms. The aim of this report is to raise awareness about the clinical significance of this anatomical variation and to highlight the importance of US imaging for diagnosis and treatment planning.

Introduction

The carpal tunnel syndrome (CTS) is a common focal peripheral neuropathy caused by pressure on the median nerve in the carpal tunnel [1]. This nerve innervates the skin of the thumb, the middle finger, the outside of the little finger and is also responsible for innervation of the thenar muscles [1]. CTS is the most frequent pressure neuropathy. Typical clinical symptoms include sensory effects in the forms of pain, paresthesia or hypesthesia, limited to the wrist area innervated by the median nerve, presence of Tinel's symptoms, or a positive Phalen's test. In more advanced cases, motor symptoms are displayed as difficulties in the performance of precise activities, grasp weakness or thenar muscle atrophy [1].

The risk factors of CTS include female sex, diabetes mellitus, hypothyroidism, obesity, arthritis, hemodialysis, acromegaly and pregnancy [1].

An unexpected cause of CTS may be thrombosis of the persistent median artery (PMA), which is an anatomical variant of hand vascularization. In a big meta-analysis containing data from 8884 adults, the prevalence of a palmar-type PMA was only 7.5%. [27] Another finding coexisting in patients with such a variation is a bifid median nerve [2,3,22]. In another study containing 300 adults, the prevalence of a PMA together with a median nerve variation was 9.3% [28]. Thus, coexistence of a PMA with a bifid median nerve in the carpal tunnel, as in our case, is an unexpected finding which can lead more easily to CTS-like symptoms if that PMA is thrombosed.

Case Presentation

A 40-year-old woman presented with progressively worsening pain in her right wrist over the past week. The pain radiated to her fingers and was accompanied by paresthesia in the right distal hand, within the median nerve distribution. The patient reported no history of injury or systemic disease. After the examination by an orthopedic physician, she was directly referred for high-resolution ultrasonography instead of Electromyography (EMG), as the former was more easily accessible for immediate appointment and would provide anatomical information as well as allow assessment of the cause of disease.

Ultrasonography and Doppler imaging revealed the presence of a bifid median nerve within the carpal tunnel accompanied by a PMA in-between the two nerve bundles (Figure 1). The examination identified focal dilatation of the artery and a segment with loss of signal flow due to thrombosis, which mimicked carpal tunnel syndrome (CTS).

Based on the above findings, the patient was treated with anticoagulants which resulted in partial alleviation of her symptoms. However, recurrence of the symptoms after discontinuation of the treatment led to surgery involving the transection of the transverse ligament (Figure 2). Following the surgery, the

patient reported immediate reduction of pain. No further anticoagulant therapy was administered. She was followed up 3 weeks later when symptoms had totally resolved.

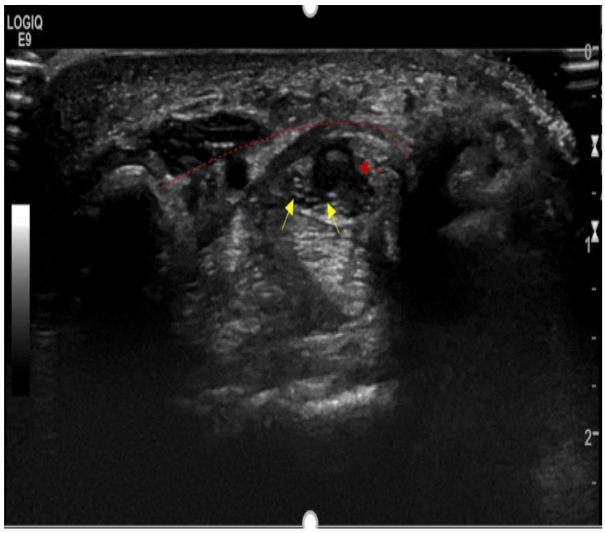

Figure 1. Transverse ligament (red dashed line), the PMA (red arrow) and the bifid median nerve (yellow arrows)

Discussion

The median nerve usually splits into two or three branches after exiting the transverse ligament covering the carpal tunnel. However, an unusual variation results in the median nerve dividing into two bundles at the distal forearm and appearing as a bifurcated median nerve in the carpal tunnel [2,3]. This is found with a frequency of 9-19% [3]. In 50% of these cases, it is accompanied by a PMA, which is located between the two nerve bundles and may be enclosed by a common epineurium [4].

During early embryonic development the middle artery is a major route of blood supply to the forearm and hand. Following the development of the ulnar and radial artery it typically regresses during intrauterine life, with its remnant being a small vessel accompanying the median nerve within the carpal tunnel [5]. Occasionally, the middle artery may remain open as a large vessel until adulthood. Two arterial patterns of the middle artery have been described in that age group [5]: 1) a forearm type, which is a small and short vessel that ends in the forearm before reaching the wrist, 2) a palmar type, which is a large and long vessel that accompanies the median nerve in the carpal tunnel and reaches the hand as a remnant of the embryonic form and is referred to as the persistent middle artery. PMA has an incidence of ~11-15% [6,7], is unilateral in ~67% of cases and is associated with a median nerve variant in ~70% (range 63-80%) of cases, most commonly with bifid median nerve [9]. In case of thrombosis of this artery and due to its close proximity with the bifid median nerve, the occurrence of symptoms resembling CTS is very likely [14,15]. It is important to note that the presence of anatomical variants of the artery and median nerve does not appear to increase the risk of CTS [12].

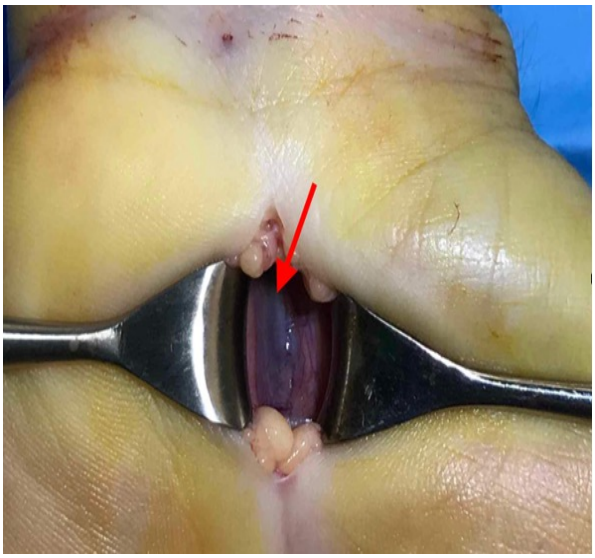

Figure 2. Intraoperative image showing the PMA (red arrow) containing the thrombus

If thrombosed it can cause pressure on the median nerve, particularly when it is covered by a common epineurium. In case symptoms present acutely, the clinical differential diagnosis includes acute tenosynovitis or acute hemorrhage into the carpal tunnel (usually secondary to warfarin use). Very few cases of PMA thrombosis causing CTS-like symptoms have been reported in the literature. In most such cases, patients usually present with acute pain and paresthesia, symptoms that resemble CTS yet often lack motor deficits and thenar muscles atrophy [7]. Khashaba

et al reported a case in which, following a working diagnosis of flexor sheath tenosynovitis, surgical exploration of the carpal tunnel revealed an occluded PMA [18]. Bartels DW et al noted motor deficits and stated that in patients presented with somewhat atypical symptoms for CTS, it is important to maintain a broad differential diagnosis [19]. Patients often present with a negative Tinnel's and Phanel's test complicating the diagnosis even more [19]. As reported by Avenel et al, in case of PMA thrombosis, the functional symptoms are secondary due to perivascular edema, rather than an ischemic mechanism [17].

EMG is most commonly used for diagnosing CTS [1]. In our case, typical clinical presentation of CTS and the acute onset of symptoms led the clinical doctor to prioritize an US over an EMG, as the former is more easily accessible for immediate appointment, better tolerated by the patient and would allow a rapid assessment of the cause of disease. Thus, the patient was directly referred to US instead of an EMG. The use of US is an established means for the diagnosis of a thrombosed PMA causing CTS-like symptoms, being an accurate diagnostic test of the syndrome also in patients with a bifid median nerve [10]. A careful examination and an experienced user are the main factors of an accurate US evaluation. In the case where the bifid median nerve coexists with PMA, their relative position in the carpal tunnel is uncertain and therefore preoperative US is necessary [11]. Finally, the use of Doppler US can reveal the intraarterial thrombus and the absence of blood flow in the PMA [12,13].

There is no consensus regarding the treatment plan in such cases. Such options include oral Anticoagulants, warfarin, LMWH analogues and surgery that may contain total excision of the thrombosed part of the PMA or simply decompression of the nerve [19,26]. In most cases in the literature, oral anticoagulants were chosen as the proper treatment [21,22,23,24]. However, Srivastava et al administered heparin intravenously followed by enoxaparin subcutaneously and warfarin orally, which also led to a full remission of the symptoms [12] There have also been cases with obvious thrombogenic backgrounds, in which the treatment plans included smoking cessation and medical treatment with aspirin and statin [17]. Though there are no specific guidelines, a confirmed thrombus in the PMA strongly suggests initiating anticoagulant medication. In our case, in agreement with a previous report, due to the persistence of symptoms surgical treatment with simple release of the transverse carpal ligament was performed which led to their full remission [20], without the need for further anticoagulant therapy. In cases of surgical treatment, it is important to note that intra-operative clamping of the PMA to assess the arterial supply to the digits is crucial [19]. Excision of the thrombosed portion of the artery should only be performed if the absence of the PMA would not affect the digits' blood flow [19]. Other authors report conservative treatment, especially in cases of relatively long course of mild symptoms [21,22,23,24,25].

Conclusion

Thrombosis of the PMA is an uncommon cause that should be considered in the differential diagnosis of acute wrist pain particularly if presenting as CTS. Preoperative US imaging is crucial for identifying such anatomical variations and diagnosing the cause of symptoms, so that appropriate treatment can be selected.

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Review

Naxos Disease: A Comprehensive Review of its Genetic Basis, Pathophysiology and Clinical manifestations

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Abstract

Naxos Disease is a rare and complex genetic disorder inherited in an autosomal recessive pattern, involving major cardiogenetic and dermatologic abnormalities. It was first discovered in the Greek island of Naxos, yet affected families have been also detected in other Aegean islands, Turkey, Israel and Saudi Arabia. Mutations in the plakoglobin and desmoplakin affecting genes lead to defects in desmosomal junctions mainly in tissues that are subject to mechanical stress, such as the myocardium and the epidermis. Organism's compensation to that specific pathophysiology, is a replacement of the damaged heart-muscle cells by fibro-fatty tissue and regarding the cutaneous tissue, a responsive hyperplastic keratin layer with palmoplantar localization. While dermatological symptoms appear from the first year of life, cardiac manifestations appear by adolescence in various symptoms and echo/ECG signs. Unfortunately, the first indication of the disease may be sudden cardiac death and there is a high risk to end up in heart failure. About the diagnostic approach, a conjunction between Task Force ARVC criteria and cardiac magnetic resonance imaging (CMR) should be taken under consideration and finally as for treatment of the condition besides symptomatic cures studies orient on genetic and molecular solutions.

Keywords: Naxos disease, pathophysiology, therapy, clinical manifestations

Introduction

Naxos Disease is an exceptionally rare and intricated genetic disorder that is inherited with an autosomal recessive pattern, which represents a significant cardiogenetic and dermatologic pathology. First discovered in the Greek island of Naxos by Dr Nikos Protonotarios and his team, is described as a special form of Arrhythmogenic right ventricular dysplasia (ARVD) that is characterized with the progressive replacement of the heart muscle cells by fat and fibrous tissue (1,2,3,4). This type of cardiac abnormalities can cause sudden cardiac death, arrythmias and early on set heart failure to affected individuals. As for its dermatological background, patients also present palmoplantar keratoderma and wooly hair. Despite that it is an uncommon condition, the impact of the disease is profound, considering that its complications may vary in severity, but many are life threatening (1,5).

The aim of this review is to examine pathophysiology including its genetic foundation, clinical presentation and as well as the latest diagnostic and management methods.

Materials and Methods

Detailed research was conducted through the published bibliography via PubMed database. The terms used for the search were "Naxos disease". To ensure accuracy and adequacy, information was gathered through a common data extraction form designed for the aforementioned keywords. The research study adhered to the guidelines of PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews), a comprehensive approach for conducting scoping reviews. Specifically, as regards the PRISMA, the records that were initially identified through PubMed search were 80. The final number of screened records was 80, as no filters were used. Based on their titles and abstracts, 68 articles were excluded due to irrelevance to the study. Hence, the specific article is based on the information retrieved from 12 reliable references (Figure 1).

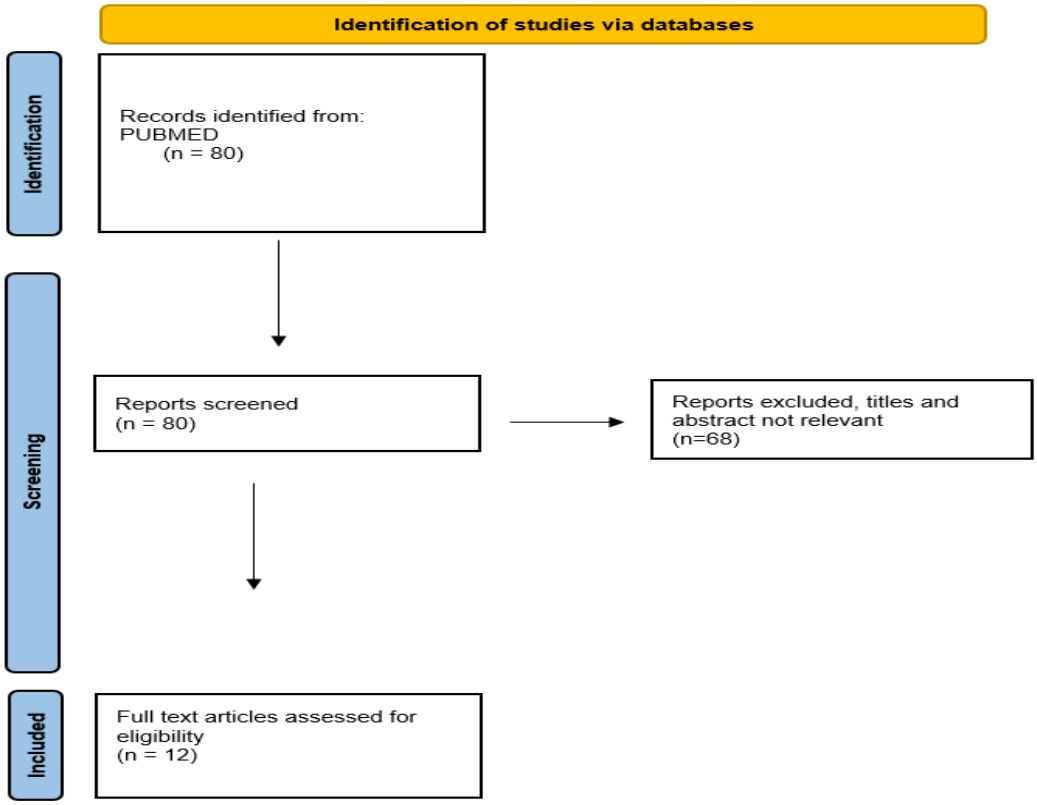

Figure 1: PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources **: title and abstract non relevant

Results

In relation to the epidemiology of the disease, it seems that it reaches 1:1000 in the population of the Greek islands and apart from Naxos, affected families are also discovered in Turkey, Israel, Saudi Arabia. Additionally, there is a rare disorder called Carvajal syndrome, detected in families from India and Ecuador, that appears to be a variation of Naxos disease. It typically manifests in younger ages with left ventricular involvement, with the consequences that will be analyzed below (1,3,4).

As for etiology, and to understand the pathophysiology of the disease, one must first delve into its genetic background. Reference point for the study of the condition was undoubtedly the identification of the Naxos gene by Dr McKenna and his team in 2000, after firstly recognizing and working on a critical zone on chromosome 17, position q21(1,2,4,6,7). The research proved that a mutation Pk2157del2TG, in the gene truncating the C-terminal of the protein Plakoglobin, is the genetic abnormality responsible for Naxos disease, and therefore homozygosity for the gene mutation is followed with Naxos disease and unfavorable prognosis. As for the heterozygous patients, the only findings in a minority of them were small ECG/echocardiographic changes, but not clinically severe characteristics were developed (1,7). Also, beside Plakoglobin, in another protein's gene, Desmoplakin, 2 different mutations have been found, specifically in genes Dsp7901del1G and DspG2375R, that also truncate the C-terminal of the protein (1). These types of genetic abnormalities were discovered in families from Ecuador and India, presented a similar cardiocutaneus syndrome (8).

Additionally, to understand why a mutation that includes plakoglobin's gene is so crucial for the

genesis of Naxos disease, one must also know about the protein's normal function (4,9). In more detail, there are two main reasons to characterize Plakoglobin essential for cardiomyocytes. Firstly, because it provides mechanical integrity to the cells by contributing to the formation of desmosomes, as it facilitates the linking of desmoplakin proteins to the intermediate cytoskeletal filaments and recruits plakophilin 3 to the membrane, where cadherin proteins are concentrated (9). Secondly, because of the protein's important role in cellular communication, with signaling activity to the nucleus and to desmosome structures (4,9). Therefore, readily one understands the major role of the protein in the cell's stability, especially in tissues subject to mechanical strength (4). Plakoglobin is also homologous with the keratin filaments found in cutaneous tissue, reinforcing its involvement in maintaining the strength and resilience of epithelial layers (1). The identification of that genetic association helped to comprehend the clinical characteristics of Naxos disease, that besides the arrhythmogenic dysplasia, also presents dermatological abnormalities. Elaborately, regarding the condition's pathophysiology, flaws in the binding sites of the mentioned homologous proteins can disrupt cytoskeletal networks, resulting, gradually, cell death and loss of the normal tissue foundation (1,3). There is a dualistic response to this harmful process, an organism's counterbalance: the damaged heart-muscle cells loss (appeared mainly in right ventricular myocardium, and mostly in the subepicardial and mediomural layers) are replaced by fibro-fatty tissue, imitating a dilated cardiomyopathy procedure, leading to insufficient contraction and creation of re-entrant ventricular arrhythmia (1,4,8). Arrhythmogenic substrate can also occur due to Plakoglobin mutation- caused reduced connexin-43 levels, that result to myocardial gap junction remodeling (1,3,8). As for the cutaneous tissue, the disruption of the desmosomal ligaments produces a responsive hyperplasia keratin layer that explains the dermatological phenotype (1,2,3,4,8).

A useful categorization for the clinical characteristics of Naxos Disease is the division of them into cardiac and extracardiac manifestations. Regarding the cutaneous phenotype, patients present wooly rough hair from birth and palmoplantar keratoderma which first appeared during the child's first year from birth while it starts using hands and feet (1,3,4,5,8,10). Both epidermolytic and non-epidermolytic histological findings were identified and were not gene specific (8). Regarding cardiac manifestations, until adolescence there was no evidence of the disease, and then ECG and/or echocardiographic abnormalities appeared. The most common anomalies (abnormal ECG in overwhelming majority) were QRS complex prolongation (QRS ≥120 ms) on V1-V3, inverted T waves (V1-V3 or across precordial leads), epsilon waves or the presence of a complete or incomplete right bundle branch block (RBBB) and ventricular extrasystoles of left bundle branch block configuration were also detected (1,2,3). The echocardiographic examination presented right ventricular dilatation and dysfunction, while diffuse hypokinesia was detected as well. Also, 'the triangle of dysplasia' which refers to aneurysms are prominent in the outflow tract, apex, and posterior wall of the right ventricle, along with noticeable impairment of the left ventricle has been recorded. It's crucial to be mentioned that the condition may appear with left or biventricular manifestations. As for the symptomatic clarification, it is usually with syncope and/or sustained ventricular tachycardia of left bundle branch block configuration, especially in young adulthood and unfortunately, the first and catastrophic sign of the disease may be sudden cardiac death (1,2,3,4,6,8,10). During the progress of time, one third of patients present symptoms before they turn thirty years old and in a ten-year follow-up heart failure was developed in ½ of the patients. Finally, as there are no exact criteria for heart participation, established Task Force ARVC criteria are commonly used in association with cardiac magnetic resonance imaging (CMR) that can detect the presence of fibrosis (scar tissue) and fatty infiltration in the heart muscle. Usage of ARVC criteria may present

significantly lower sensitivity, and they shouldn't be taken into consideration as the only method used (1,3,6,10).

Regarding therapeutic management Naxos disease requires multidisciplinary approach, including cardiac care to manage arrhythmias and heart failure and dermatological care for skin issues (1,4). Firstly, for prevention of sudden cardiac death for symptomatic patients with ECG/echocardiographic abnormalities, an implantation of an automatic cardioverter defibrillator should be considered. Also, antiarrhythmic drugs; solatolol and amiodarone are recommended for episodes of VT either alone or in conjunction with b-blockers. Meanwhile in late stages that heart failure is presented, the usual therapeutic approach is indicated, including beta-blockers, ACE inhibitors and diuretics (1,4). Additionally, it's important to mention that genetic counseling and lifestyle modifications, such as exercise restrictions, are also key components of managing the disease (1,4,11). About genetic and molecular mechanisms, latest researches have shown that that's the path that could possibly present an actual therapeutic solution. Specifically, Dr Kessler and team, by experimenting with Zebrafish models and rat cardiomyocytes with induced plakoglobin mutations, discovered that drug SB216763 (SB21) managed to save and partially restore the Arrhythmogenic Cardiomyopathy (ACM) phenotype (1,11). However, this is the only information provided, and more data needs to be discovered in new heart models. Lastly, studies on induced pluripotent stem cells (iPSCs) such as Dr. K Walz and team paper have yielded encouraging outcomes, aiding in the advancement of treatment approaches (1,12).

Conclusion

Naxos Disease constitutes a rare genetic disorder with significant cardiological, and dermatological effects caused by the mutations in Plakoglobin and Desmoplakin genes. Even though there are very few studies especially about its diagnostic criteria, early detection and genetic screening are crucial from preventing disastrous outcomes such us sudden cardiac death. While the disease remains challenging, ongoings studies across the scientific community, especially the ones oriented towards a molecular and cellular background, seem to be closer than ever to present rational answers about a deeper understanding of the disease and therefore the discovery of more specific and effective treatments.

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Case Report

Gastric remnant perforation from nasogastric tube after subtotal gastrectomy – a case report of an odd cause of early leakage

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Abstract

Nasogastric tube (NGT) insertion for either enteral feeding or gastric decompression is a common and generally considered safe procedure. [1-I]. There have been some reports of alimentary tract perforation mainly in neonates and infants, with only sparse reports of perforation in adults. Here, we present a case of early postoperative leakage attributed to perforation from the NGT inside the gastric remnant.

Introduction

Subtotal gastrectomy is the procedure of choice for tumors located in the lower part of the stomach. A rare and not-so-often thought-of complication may arise from the postoperative use of a nasogastric drainage tube. In this case report, we present a case of a gastric remnant perforation due to pressure from a nasogastric tube looping inside the gastric remnant following subtotal gastrectomy and D2 lymph node resection in a 74-year-old. We aim to emphasize the potential complications associated with the use of NGT postoperatively and the importance of careful patient monitoring to proceed to prompt intervention if the need arises. To our knowledge, this is the first reported incident of a gastric remnant perforation from an NGT loop pressuring the gastric wall.

Case Presentation

A 74-year-old female presented at our clinic for a scheduled subtotal gastrectomy and D2 lymph node resection after being diagnosed with Lauren diffuse type gastric adenocarcinoma located at the distal- third of the lesser curve of the stomach. She had no significant medical history apart from hypertension and dyslipidemia and she had no previous surgeries to declare. Her body mass index (BMI) was 38 kg/m2.

She received preoperative mechanical bowel preparation as well as prophylactic antibiotic coverage with cefuroxime/metronidazole as per our clinic's protocol.

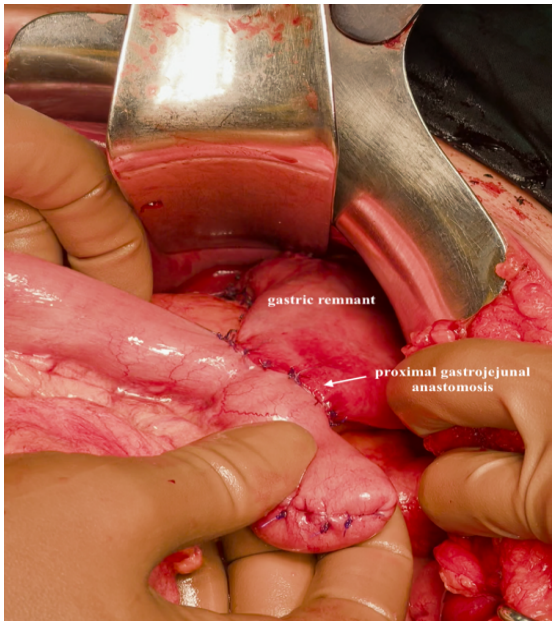

Figure1: surgical side after subtotal gastrectomy and D2 lymph node resection with the gastric remnant visible

The surgeon chose an open approach, and an upper midline incision was performed extending from the xiphoid to approximately 3cm below the umbilicus. The palpable mass was confirmed to be at the lower 1/3 of the stomach, so a subtotal gastrectomy was the procedure of choice. After meticulous dissection, the stomach was divided from high on the lesser curve of the stomach up to the middle of the greater curve, and a Roux-en-Y reconstruction of the gastrointestinal tract was performed. The gastrojejunal anastomosis was performed with a circular stapler reinforced by interrupted full thickness polyglactin sutures. The duodenal stamp's staple line was also reinforced with interrupted sutures as was the gastric staple line. Two closed drains were placed, one at the side of the duodenal stamp and the other at the side of the gastrointestinal anastomosis.

Intraoperatively, a 16Fr Polyvinyl Chloride (PVC) NGT was placed by the anesthesiologist and the surgeon assisted transabdominally for postoperative decompression and prevention of aspiration taking into consideration that a post-operative blind placement if an NGT was needed would be difficult and associated with added risk due to the nature of the surgery.

During the procedure, the short splenic arteries above the proximal half of the greater curve remained untouched and the remnant stomach above the line of dissection remained with no manipulations and no stay sutures were used due to the relatively large size of the remnant.

Eighteen hours after surgery the patient complained of epigastric pain which radiated the right upper quadrant. On clinical examination she was afebrile, and her heart rate was 80 bpm and blood pressure 140/80 mm Hg. Right upper quadrant and epigastric tenderness were present on palpation, without rebound or percussion tenderness. Her laboratory tests showed: C reactive protein 11.34 mg/dL, a white cell count of 13.32 K/L, and a hemoglobin level of 11.7 g/dL.

Two hours after the initial assessment, greenish turbid fluid presented in the drainage tube – no more than 5-6ml. Re-evaluation of the patient presented mild rebound tenderness and localized peritonitis. An abdominal computer tomography (CT) scan with water-soluble oral contrast was ordered which revealed a contrast leak near the left subphrenic space. The nasogastric tube was visible forming a loop inside the gastric stump and in closed contact with the gastric wall. An emergency laparotomy was deemed necessary to investigate the cause of the leak and prevent the development of diffuse peritonitis.

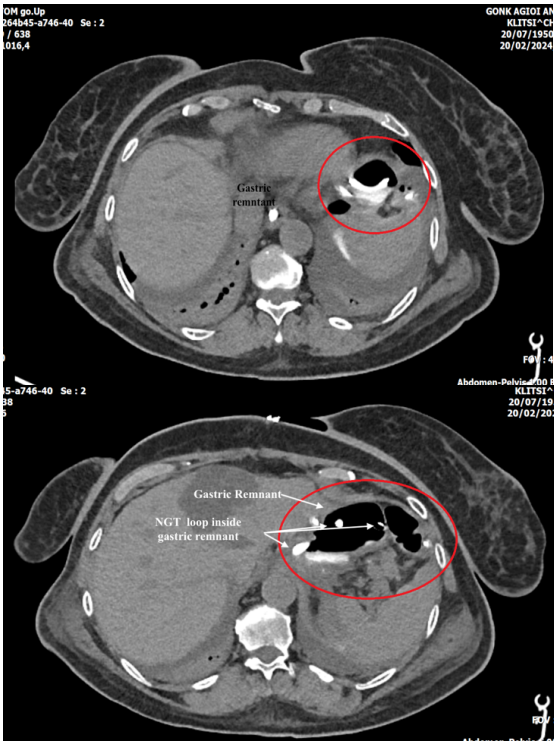

Figure2,3: CT scan showing the NGT looping inside the gastric remnant

The initial incision was reopened and after the first assessment, both the duodenal stump incisional line and the two anastomotic sides of the Roux – en -Y anastomosis were intact. The leak was due to a perforation of the gastric remnant at the gastric fundus near the cardiac notch. Inside the gastric remnant, the nasogastric tube was visible through the deficit forming a loop with the convex section exerting constant pressure on the gastric wall. Taking into consideration that no surgical dissections or handlings were performed at that region and the visible pressure on the gastric wall from the NGT

loop, the gastric perforation could only be attributed to the NGT.

After debriding of the perforation side, a primary repair was performed, and the defect was primarily closed with Vicryl 2-0 suture. Extensive abdominal washout followed and the drainage tubes were replaced. The abdominal wall was closed with a PDS no1 loop suture.

The patient had an uneventful recovery with the time of the first flatus being the second postoperative day and the patient starting oral feeding on the third postoperative day. The discharge was nine days after the first surgery, and she has a steady recovery at 12-month follow-up period.

Discussion

Gastric perforation is a life-threatening cause of acute abdomen which can either be traumatic, ischemic or spontaneous, with the most common cause being spontaneous perforation due to peptic ulcer disease. Iatrogenic causes of spontaneous gastric perforation such as nasogastric tube (NGT) and orogastric tube placement are extremely rare although these intubations are frequently performed in surgical patients.

In the adult population, oesophageal and pharyngo-oesophageal perforation is more common as a nasogastric tube placement complication than gastric perforation, which is more common in pediatric population

Ghahremani et al described a series of six cases with gastric perforation after NGT placement and documented salicylate use, gastric anastomosis, and metastatic gastro-oesophageal cancer as potential risk factors. [2-A].

There are also reports in the literature of gastric perforation from NGT placement in elderly patients or patients with connective tissue disorders [2-A,3-B,4-C,5-G] and to patients who had undergone surgery [6-D,7-E]. Daliya et al presented a case of gastric perforation in a 32-year-old male from NGT intubation after laparotomy for acute intraabdominal bleeding, [3-B] and Lee et al a 63-yar-old patient with gastric perforation after NGT placing for feeding. [4-c] Van Dinter et al report a case of gastric perforation in a female patient nine years after Roux-en-Y gastric bypass. [6-D] and Morell et al, a 39-year-old patient with a history of gastric sleeve surgery and rupture after intra-operative NGT placement for thyroidectomy [7-E].

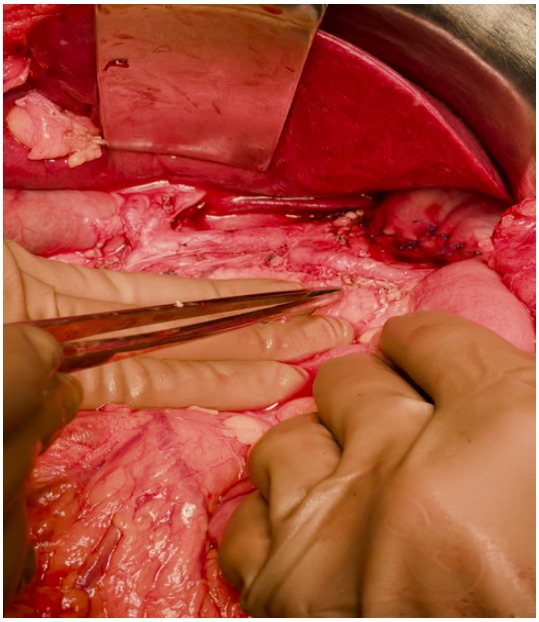

Figure 4: the side of the gastric remnant perforation

To our knowledge, this is the first reported case of a gastric remnant perforation from an intraoperative placed NGT after subtotal gastrectomy.

The exact mechanism of perforation is not clarified, but taking into consideration that surgical manipulation was performed near the perforation site, the local blood supply was not compromised and a clear coiling of the NGT was visible through the perforation deficit with the tube actively pressuring the gastric wall, the evidence suggests that the perforation was directly linked to the NGT. We theorize that the NGT may have been dislocated during extubation, causing the formation of a rigid loop inside the gastric remnant. In literature, size, stiffness and tendency of NGT material such as polyethylene, polyvinyl chloride or latex to interact with gastric acid and become more rigid have been flagged as possible contributing factors of gastric wall erosion [4-c]

Most often, postoperative leakage after gastric

surgery is due to anastomotic side leak from any side with a staple line or sutures and occurs between 5 and 10 days after surgery. The incidence of leakage in literaturee ranges between 0 and 17%, and mortality increase due to the leakage is reported. The patient will present mostly with tachycardia, hypotension, and abdominal pain up to acute abdomen. The treatment depends on the severity of the clinical presentation.

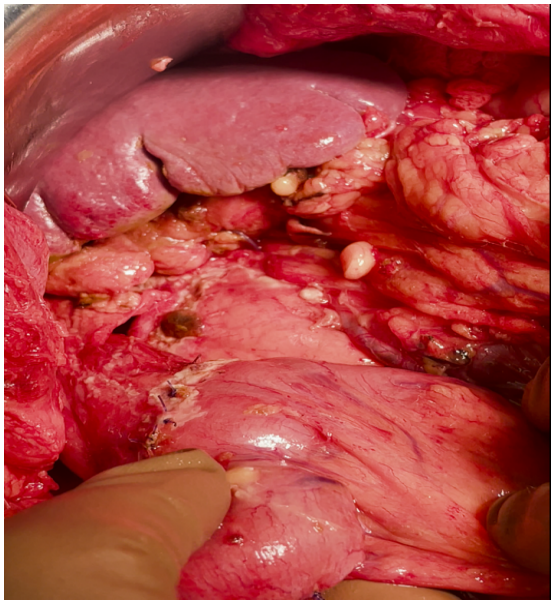

Figure5: The intact gastrojejunal anastomosis

Conservative treatment can be considered in stable patients with broad-spectrum antibiotics, nutritional support, and fluid infusion whereas an unstable patient requires an exploratory laparotomy and closure of the leakage site. In our case, the early leakage (<72 h after the operation) and the onset of signs of peritonitis deemed the surgical re-intervention necessary with the aim of potential direct closure of the leakage. [8-H]

The prophylactic use of NGT for decompression, reduction of aspirational risk from nausea and vomiting, and prevention of postoperative distention due to paralytic ileus, thus improving anastomotic safety, have been shown as nonbeneficial in various metanalysis [9-J]. Despite that, many surgeons continue to use NGTs in the early postoperative period after gastric resection, in cases where anew placement may be difficult or associated with added risks, such as prior gastric or bariatric surgery, hiatal hernia, esophagotomy, or in patients who may not be able to cooperate postoperatively[10-F]. In our case, the added risk of an injury from a blind placement and the extensive dissection needed for the D2 lymphadenectomy that undeniably affects intestinal motility after surgery contributed to the decision to keep the NGT postoperatively.

Conclusion

The case presented is a rare cause of early leakage after subtotal gastrectomy that was attributed to NGT perforation of the gastric remnant. This case report highlights the potential complications associated with the use of NGT postoperatively and the importance of careful patient monitoring to proceed to prompt intervention if the need arises. Although extremely rare, the surgeon must be aware of the risk of NGT perforation both during the placement but also after the extubation of the patient. Close monitoring and early intervention in case of diffuse peritonitis is also vital.

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