J Turk Spinal Surg 2025;36(1):35-39
DOI: 10.4274/jtss.galenos.2024.73792

EVALUATING INCIDENTAL FINDINGS IN CERVICAL MRI SCANS: THE PREVALENCE AND CLINICAL RELEVANCE OF INCIDENTAL FINDINGS

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ABSTRACT

Objective: This study aims to examine the frequency, types, and clinical significance of incidental findings in cervical magnetic resonance imaging (MRI) scans and their implications for patient care.

Materials and Methods: A total of 331 cervical MRI scans were reviewed retrospectively at Karabük University Research and Teaching Hospital between April 2022 and April 2023. Patients presenting with arm and neck pain or symptoms suggesting abnormalities of the cervical spine were included; those whose images were affected by artifacts were excluded. Incidental findings were recorded and categorized according to their type, location, and potential clinical significance.

Results: Our cohort consisted of 221 female patients (69%) and 101 male patients (31%), amounting to a total of 322 patient records. Loss of cervical lordosis (71%) and cervical disc herniation (92%) were the most prevalent findings in the cervical spine. Additional findings included syringomyelia, cerebellar tonsillar herniation, and empty sella. After being diagnosed with thyroid cancer, one patient received appropriate care. The distribution of incidental findings by gender was not statistically significant. This study highlights the frequency and variety of incidental findings in cervical MRI scans, along with their possible clinical significance. The findings are consistent with earlier studies, highlighting the necessity of carefully analyzing these results to detect potentially fatal disorders.

Conclusion: It is crucial not to overlook incidental abnormalities in cervical MRI scans for the early identification of clinically relevant disorders. Future research should concentrate on creating uniform protocols for handling incidental results to successfully balance clinical benefits and resource consumption.

Keywords: Cervical MRI, incidental findings, cervical spine, extraspinal findings, thyroid nodules

INTRODUCTION

Cervical magnetic resonance imaging (MRI) is a sophisticated imaging method commonly employed for identifying neck and spine disorders. This treatment offers a thorough assessment of the cervical area because of its exceptional soft tissue contrast and ability to capture images from several angles[1]. The request for a cervical MRI is usually prompted by specific indicators such as neck pain, radiculopathy, myelopathy, or trauma[2]. Cervical MRI enables doctors to obtain precise and comprehensive images of the anatomical structures and potential abnormalities in the cervical area of the spine. This information is crucial for clinicians to accurately diagnose and plan appropriate treatments. MRI is often regarded as the most reliable method for identifying diseases such as disc herniations, spinal stenosis, degenerative changes, malignancies, and infectious processes[3]. Nevertheless, a cervical MRI often reveals other findings that are unrelated to the main purpose of the examination. The term "incidental findings" is used in the literature to describe

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Received: 24.12.2024 **Accepted:** 14.01.2025 **Epub:** 16.01.2025 **Publication Date:** 22.01.2025
Cite this article as: Köremezli Keskin N, Yurtluk MD, Başdemirci M, Başdemirci O, Taçyıldız AE, Akbarov P, et al. Evaluating incidental findings in cervical MRI scans: the prevalence and clinical relevance of incidental findings. J Turk Spinal Surg. 2025;36(1):35-39.

these unanticipated discoveries[4]. Incidental results are highly influential in clinical practice. Although some of these findings may not show any symptoms and may not be clinically important, in specific situations, they can help in the early detection of life-threatening diseases[5].

Incidental findings have gained growing attention due to their rising occurrence and clinical importance in recent years. Research has indicated that chance discoveries on cervical MRI scans are extremely prevalent. Typical findings that are not the main focus but are often discovered in cervical MRI scans include degenerative disc disease, spinal stenosis, osteophytes (bone spurs), and facet joint arthrosis (joint degeneration). In addition, the identification of incidental findings can potentially uncover less common but medically important disorders such as Chiari malformation, syringomyelia, spinal cord malignancies, or anomalies in the vertebral artery[6-10].

The objective of this study is to examine the occurrence, categories, and medical importance of diseases that are unintentionally discovered in individuals undergoing cervical MRI scans. In addition, the study will investigate the impact of these findings on patient care and the degree to which they change the necessity for further testing or treatments. Based on the provided information, the project seeks to implement a more thorough strategy for evaluating cervical MRI scans and provide guidance to clinicians on how to handle incidental discoveries. This study aims to conduct a retrospective analysis of cervical MRI images from individuals who were examined during a certain period. The primary objective is to document any unexpected or incidental results. We shall categorize these discoveries according to their classifications, positions, and medical importance. In addition, we will assess the influence of these discoveries on patient care and determine if any further examinations or therapies are required. Ultimately, this study aims to perform a thorough exam of diseases incidentally discovered on cervical MRI scans and provide insights into the appropriate management of these findings in a clinical setting. The acquired data will guide professionals in diagnosing and treating patients, potentially leading to early diagnoses that could save lives. Moreover, this work will establish a basis for subsequent extensive research.

MATERIALS AND METHODS

Patient records were evaluated between April 2022 and April 2023 after approval from Karabük University non-interventional clinical research ethics committee (approval number: 2024/1873, date: 17/09/2024). Three hundred and thirty-one patient records were assessed, and nine patients were excluded due to artifacts disabled by investigating the cervical images. Patients with neck and arm pain, claudication, or any symptom that might indicate cervical disc herniation, radiculopathy, and canal stenosis with a cervical MRI were included in this study. Patients were excluded if they had distorted MRI images due to surgical or movement artifacts that may have enabled the clinician or radiologist to thoroughly investigate the natural anatomy of the cervical region.

Image Acquisition

All images were acquired with a 1.5 Tesla MRI scanner using a 20-channel neck coil (Magnetom Aera, Siemens Healthcare, Erlangen, Germany). The images included in the investigation were T1-weighted sagittal spin-echo, T2-weighted sagittal turbo spin-echo, and T2-weighted axial turbo spin echo. Although axial images were not continuous, four axial slices were obtained for each cervical intervertebral disc, primarily focusing on the intervertebral disc pathologies. Following the evaluation of regional pathologies and classification, each lesion and incidental findings were recorded for each patient. Patients were referred to appropriate departments according to incidental findings.

Diagnosis

Two independent radiologists and one neurosurgeon have reviewed the MRI images. Nasopharyngeal mucosal thickening was measured on sagittal, T2 sequences, and >3 mm mucosal thickness was accepted as mucosal thickening[11]. Cysts with distinct margins along the nasopharyngeal posterior wall are termed Tornwaldt cysts if they are in the midline, otherwise termed retention cysts[11]. >3 mm was also accepted as mucosal thickening for paranasal sinus mucosal thickness[12]. For the Thyroid Gland, enlargement of each lobe is accepted as >20 mm in the anteroposterior dimension or the Isthmus being thicker than 10 mm[13]. Sellar and parasellar regions were meticulously investigated. For empty sella diagnosis, more than half of the sella needed to be filled with cerebrospinal fluid, and the pituitary thickness needed to be <2 mm, while partial empty sella diagnosis made if less than half of the sella was empty and the pituitary had ≥3 mm thickness[14]. Cerebellar tonsillar herniation diagnosis was made if the tonsils were below ≥3 mm of the foramen magnum[15].

Statistical Analysis

Jamovi (version 2.4.7) was used for all statistical analyses. Categorical variables were dichotomized and presented as frequencies and percentages, while continuous data were summarized as means ± standard deviations, with normality assessed using the Shapiro-Wilk test. Comparisons of categorical variables were conducted using the chi-square test or Fisher's exact test, as appropriate. Differences in continuous variables between groups were analyzed using independent samples t-tests or Mann-Whitney U tests, depending on the data distribution.

A p-value of <0.05 was considered statistically significant, and all analyses were conducted using a two-tailed approach.

RESULTS

The cohort was mainly made up of females (n=221, 69%), while males comprised 31% of the cohort (n=101). The demographics

are summarized in Table 1. Cervical disc herniation and loss of cervical lordosis lead to the cervical spinal column findings, 92% and 71%, respectively, outlined in Table 1. In total, 105 (33%) patients presented with extraspinal cervical findings, summarized in Table 2. Nasopharynx posterior wall thickening was the most common incidental finding (7%), followed by thyroid nodules and multinodular guatr, both 6%.

Furthermore, 15 patients have been found to have empty sella, while nine patients had cerebellar tonsillar herniation, although only three patients had syringomyelia (Table 2). One patient had laboratory and advanced imaging results suspicious of thyroid malignancy and, after further investigation, underwent thyroidectomy and appropriate medical therapy. Lastly, there were no statistical differences in rates between gender groups in the most commonly encountered eight pathologies, summarized in Table 3.

DISCUSSION

MRI of the cervical spine is a routine examination in several different departments and may be employed to investigate certain malignancies, including thyroid, parotid nasopharynx, and larynx. Furthermore, it may be utilized to investigate musculoskeletal disorders. Due to the complex and close anatomy of the several systems within the cervical region, it is easy to miss other findings besides the most apparent one. Our study aims to investigate incidental findings within a patient group where cervical MRI is utilized to investigate underlying arm and neck pain. Naturally, the most common findings were cervical disc herniation and loss of lordosis, resulting in signs of radiculopathy and neurologic deficits. Furthermore, careful evaluation of the scans revealed several additional incidental findings, most commonly nasopharynx posterior wall thickening and thyroid nodules.

Previous studies have made a point in this matter. Kızılgöz et al.[16], in their study including 1000 patients, revealed nasopharyngeal mucosal thickening was the most common cause of incidental findings, followed by thyroid gland enlargement, paranasal mucosal thickening, and thyroid nodules, which reflects our results in the bigger scale although the incidences vary. Nasopharyngeal and paranasal mucosal thickening can be linked to seasonal allergies or chronic rhinosinusitis, which is very common in the general population. Thyroid nodules were another incidental finding within their study in 16.4% of patients. Whether this is a subclinical situation or patients do experience symptoms of hyper-or hypothyroidism is a matter of meticulous clinical and laboratory investigation. Our results indicate a 6% thyroid nodule incidence rate. While most thyroid nodules are benign and can present in a significant portion of patients, it is imperative to do a thorough work-up to exclude any underlying malignancy.

Özdemir and Kavak.[17] have found a 49.6% rate of thyroid nodule incidence within their cohort, further revealing papillary thyroid carcinoma in three patients. Also, one other important finding was vertebral hemangiomas within our cohort. Kaya et al.[18] and Kızılgöz et al.[16] have commented on this previously.

Managing incidental findings involves addressing ethical and legal problems. It is the ethical duty of clinicians to notify patients about incidental findings that have been found and to provide suitable ways for managing them. Nevertheless, this might occasionally result in superfluous distress and supplementary examinations. Hence, it is crucial to embrace a

Table 1. Cohort demographics and cervical spine MRI findings

N. of patiens (mean age ± SD)	322 (51.4±14.1)
	N. of patients (%)
Female (mean age ± SD)	221 (52.2±13.6)
Male (mean age ± SD)	101 (49.6±14.9)
Cervical disc herniation	297 (92%)
Increase in lordosis	5 (2%)
Loss of cervical lordosis	230 (71%)
Canal stenosis	13 (4%)
Thickening of the posterior longitudinal ligament	1 (0.3%)
Anthelisthesis	1 (0.3%)
Spinal hemangioma	58 (18%)
Cervical degeneration	11 (3%)
Schmorl's nodes	7 (2%)
Sclerotic bone lesion	3 (1%)
Syringomyelia	3 (1.2%)
Spinal instrumentation	1 (0.3%)
Myelomalasia	2 (0.6%)
Block vertebra	1 (0.3%)
Thickening of the ligamentum flavum	1 (0.3%)
Vertebral fusion anamoly	2 (0.6%)
Perineural cyst	4 (1.2%)

MRI: Magnetic resonance imaging, SD: Standard deviation

Table 2. Incidental extraspinal cervical findings

	N. of patients (%)
Thyroid nodules	18 (6%)
Nasopharynx posterior wall thickening	22 (7%)
Multinodular guatr	18 (6%)
Paranasal sinus mucosal thickening	12 (4%)
Cerebellar tonsillar herniation	9 (3%)
Empty sella	15 (5%)
Tornwaldt cyst	7 (2%)
Maxillary sinus retantion cyst	7 (2%)
Parotid lesion	1 (0.3%)
Pituitary lesion	1 (0.3%)
Tonsil hypertrophy	1 (0.3%)
Increase in thyroid size	1 (0.3%)
Thyroidectomy	1 (0.3%)

Table 3. Cross table for dependent gender

	N	Male (N=101)	Female (N=221)	Test statistic
Thyroid nodules	322	9/101	9/221	P=0.08
Nasopharynx posterior wall thickening	322	10/101	12/221	P=0.14
Multinodular guatr	322	4/101	14/221	P=0.39
Paranasal sinus thickening	322	6/101	6/221	P=0.16
Cerebellar tonsillar herniation (Chiari type 1)	322	1/101	8/221	P=0.18
Empty sella	322	2/101	13/221	P=0.12
Tornwaldt cyst	322	4/101	3/221	P=0.14
Maxillary sinus thickening	322	4/101	3/221	P=0.14

N is the number of non-missing values

well-rounded strategy while disclosing fortuitous discoveries and interacting with patients.

An interdisciplinary strategy is essential for effectively handling unexpected cervical MRI findings. Effective collaboration among experts from several fields, including radiology, neurology, neurosurgery, and physical therapy, is essential for effectively interpreting these data and deciding on suitable treatment approaches. Another crucial consideration regarding incidental results is the cost-effectiveness and the impact it has on the healthcare system. Superfluous supplementary examinations and therapies can result in elevated healthcare costs. Therefore, it is crucial to create and apply evidence-based standards for managing incidental results.

Our study is not without its limitations. Being a single-institution study and having a small cohort impacted the generalizability of our findings. Furthermore, the examination of the MRI scans is individual and highly dependent on the examiner's level of experience and the quality of the workstation. The close and intricate anatomy of the cervical region also makes it harder for radiologists to identify individual structures within proximity.

There is a specific need for additional studies to be conducted on the long-term clinical results and how they affect the way patients are treated when it comes to accidental findings. Recommendations for further research are typically presented in the discussion to emphasize knowledge gaps identified during the study.

Conclusion

Incidental findings in cervical MRI scans can lead to life-changing discoveries in patients and should not be disregarded. Our findings underscore the careful evaluation to determine the clinical significance and guide patients to appropriate care. Future research can focus on streamlining and standardizing the guidelines to discover incidental findings as a secondary aim besides the primary goal of evaluation of the spinal column and spinal cord.

Ethics

Ethics Committee Approval: Ethical approval for the study was obtained from the Karabük University Non-interventional Clinical Research Ethics Committee (approval number: 2024/1873, date: 17/09/2024).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: N.K.K., M.D.Y., O.B., P.A., A.S.A., Concept: N.K.K., O.B., A.E.T., P.A., A.S.A., Design: N.K.K., M.B., A.E.T., P.A., A.S.A., Data Collection or Processing: N.K.K., M.D.Y., O.B., A.S.A., Analysis or Interpretation: N.K.K., M.B., A.E.T., P.A., A.S.A., Literature Search: N.K.K., M.D.Y., M.B., A.E.T., P.A., A.S.A., Writing: N.K.K., M.B., O.B., A.S.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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