Global Advanced Research Journal of Medicine and Medical Sciences (ISSN: 2315-5159) Vol. 6(9) pp. 234-239, September, 2017
Available online http://garj.org/garjmms

Full Length Research Paper

Extraspinal Incidental Findings on Routine MRI of Cervical Spine

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Accepted 22 September, 2017

The aim of the present study was to determine the prevalence and reporting rate of incidental findings (IF) on the magnetic resonance imaging (MRI) scans of cervical spine, to find the frequencies of these incidental findings, and to emphasize the clinical importance of them. Scan of a total of 266 cervical spine MRI (collected from patients with a mean age of 46.6±16.3 years, range 1–80 years) during the period from August 2016 to April 2017. The images interpretation was done by a two consultant radiologists. A total of 45 IFs were found in 266 patients (16.9% of 266). Among these, clinically significant IFs (n = 45) included: 16 thyroid nodules (6.3 %), 12 thyroid goiter (4.6%), 7 mucosal thickening in paranasal sinuses (2.68 %), 2 Tornwaldt cyst (0.76%), 1 cystic hygroma (0.37%), 1 colloid cyst (0.37%), 3 polyps/retention cyst (1.14%), 1 cancer of the thyroid (0.37%), 1 pituitary macro adenoma (0.37%) and 1 lymphadenopathy. The MRI examination of intervertebral discs, paying attention to incidentally detected pathological extraspinal findings is very important due to the fact that they can alter the treatment of the patient or affect the patient's life. Therefore, they should be included in the reports since they will give additional and valuable information.

Keywords: Incidental findings, cervical spine, Magnetic resonance imaging, Extra-spinal findings

INTRODUCTION

Incidental findings (IF) are usually asymptomatic abnormalities other than expected pathologies, which are encountered during radiological examinations. In recent years, advances in digital evaluation of radiological imaging (e.g., high magnification zoom, the ability to focus on individual images, and digital archiving) have dramatically improved detection limit of incidental lesions (Wagner et al., 2002).

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Magnetic resonance imaging (MRI) of the cervical spine is frequently performed to evaluate patients with neck pain. The images for reporting are commonly magnified around the vertebral column cropping out much of the structures within the neck. While this provides optimal delineation of spinal pathologies, it potentially results in the exclusion of important extraspinal pathologies from the final dataset. Given the simplicity of providing wide field of view reconstructions that encompass these structures (Yap et al., 2015).

Also a lot of radiologist doesn't observe the anatomic structure outside of the immediate region of interest and this doesn't creates opportunities for early detection of potentially life threatening conditions such as malignancies and aneurysms (Wagner et al., 2002).

We aimed to investigate the prevalence and reporting rates of extraspinal findings that were incidentally detected on the magnetic resonance imaging (MRI) scans of cervical spine, to find the frequencies of these incidental findings, and to emphasize the clinical importance of them.

We have examined the incidence and type of extraspinal incidental findings revealed by wide field of view review.

MATERIALS AND METHODS

Between august 2016 and April 2017, a retrospective study including 266 Consecutive patients (141 females and 125 males with a median age of 46.6±16.3 years) was conducted by evaluating a total of 266 MRI examinations.

The age distributions were as follows: 1–20 years, 21-40 years, 41-60 years and 61-80 years.

Most of the patients complained of chronic neck pain with the duration of symptoms ranging from several months to several years.

The patients who gave any information of a previously known extraspinal pathology (extraspinal masses, cancer, etc) were excluded. This retrospective study did not need informed patient consent.

MR Imaging technique

Examinations were performed on a 1.5 Tesla MRI unit (Toshiba Medical Systems) at Alzytouna Specialist Hospital, 1.5 Tesla (Toshiba Medical Systems) at Dar Al-Elaj specialist hospital and 1 Tesla (SIMMENS Medical Systems) at Al-Nelian diagnostic Center with spine coil. All patients were put in supine position. The routine cervical spinal MR protocol in alzytouna hospital includes a three-plane localizer series and sagittal T1-weighted Fast spin-echo (TSE) images (Repetition Time (TR) / Echo Time (TE), 600-700/9-10 ms; slice thickness/interslice gap, 4/ 0.4 mm, field of view (FOV), 32 cm and NEX, 2), sagittal T2-weighted FSE images (TR/TE, 3000/108 ms; slice thickness/ interslice gap, 4/0.4 mm , field of view (FOV), 32 cm and NEX, 2) and axial T2-weighted GE (TR/TE, 350-400/9-10 ms; slice thickness/interslice gap, 4/0.4 mm, flip angle 20° , field of view (FOV), 32 cm and NEX, 2).

The routine cervical spinal MR protocols in DAR ALELAJ hospital includes a three-plane localizer series and sagittal T1-weighted Fast spin-echo (TSE) images (Repetition Time (TR) / Echo Time (TE) , 600-700/9-10 ms; slice thickness/interslice gap, 4/ 0.4 mm , field of view (FOV), 32 cm and NEX, 2), sagittal T2-weighted FSE images (TR/TE, 3000/108 ms; slice thickness/ interslice gap, 4/0.4 mm , field of view (FOV), 32 cm and NEX, 2) and axial T2-weighted GE (TR/TE, 350-400/9-10 ms; slice thickness/interslice gap, 4/0.4 mm, flip angle 20° , field of view (FOV), 32 cm and NEX, 2).

The routine cervical spinal MR protocol in Al-Nelain diagnostic Center included a three-plane localizer series and sagittal T1-weighted Fast spin-echo (TSE) images (Repetition Time (TR) / Echo Time (TE) , 400/14 ms; slice thickness/interslice gap, 4/ 4 mm , field of view (FOV), 32 cm and NEX, 2), sagittal T2-weighted FSE images (TR/TE, 4500/144 ms; slice thickness/ interslice gap, 4/4 mm , field of view (FOV), 32 cm) and axial T2-weighted GE (TR/TE, 625/26 ms; slice thickness/interslice gap, 4/4 mm, flip angle 20°, field of view (FOV), 32 cm and NEX, 2).

Image analysis

MR examinations were interpreted in consensus by two radiologists who had 5 and 2 years of experience, respectively, from PACS. The radiologists evaluated the MR examinations for the presence of variable incidental findings in the spine. The study defined incidental finding to include any abnormal finding not related to the chief complaint. The following pathologic conditions were recorded: Thyroid nodules, Mucosal thickening in Paranasal sinuses, Thyroid goiter, Tornwaldt cyst, Cystic hygroma, Colloid cyst, Polyps\retention cyst, Ca thyroid, pituitary macro adenoma and Lymphadenopathy

A Thyroid nodule was diagnosed when signal intensity was decreased on T1-weighted images, signal intensity was markedly increased on T2-weighted images (Figure 2).

Thyroid goiter was diagnosed when the size of thyroid increased (Figure 3).

Tornwaldt cyst, Cystic hygroma was diagnosed when signal intensity was decreased on T1-weighted images, signal intensity was markedly increased on T2-weighted images.

Thyroid lesions almost all (benign and malignant) thyroid lesions showed either homogeneous or heterogeneous increased intensity on T2-weighted images.

Regions of high intensity in the thyroid on T1- weighted images may be due to colloid cyst.

Papillary carcinomas usually have indistinct margins. Though a vast majority of multinodular thyroid abnormality is benign, malignancy has been reported in incidentally discovered.

A solitary thyroid incidental lesion may need further clinical evaluation, biochemical thyroid status assessment, ultrasound examination, and fine-needle aspiration.

Mucosal thickening, identified by a high signal on T2WI and a low signal on T1WI following the peripheral border of the sinus.

Polyps and retention cysts, identified as circumscribed, homogeneous, dome-shaped areas with high signals on T2WI. Polyps and retention cysts cannot be unambiguously differentiated by MRI.

RESULTS

This study included (266) patients, males (125) and (141) females, (266) who underwent MRI of the cervical spine as part of an evaluation for clinically suspected intervertebral disk diseases.

In a total of 266 cervical spine MRI examinations, the percentage of incidental findings was (16.9 %).

The thyroid nodules (Figure 2) were the most common incidental findings (16 cases, 6.30%) of all cervical spine incidental findings followed by thyroid goiter (Figure 3) (12 cases, 4.6%), mucosal thickening in para nasal sinuses (7 cases, 2.68%), the other incidental findings are given in (Table 2).

The distribution of incidental findings according to age groups was as follows: 1– 20 years old, Patients (5%); 21–40 years old, 10 patients (22 %); 41–60 years old, 23 patients (51 %); and 61 years old or older, 10 patients (22 %) this distribution was shown in (Figure 1).

Table 1. Demonstrates the percentage of incidental findings from all data.

	Patient's n (%)
Normal findings	221 (83.1 %)
Incidental findings	45 (16.9 %)
Total	266 (100%)

Table 2. The distribution of incidental extraspinal pathological findings on 266 cervical spinal MRI examinations.

	Patient's n (%)
Normal	221 (83%)
Thyroid nodules	16 (6.30%)
Mucosal thickening in Paranasal sinuses	7 (2.68%)
Thyroid goiter	12 (4.6%)
Tornwaldt cyst	2 (0.76%)
Cystic hygroma	1 (0.37%)
Colloid cyst	1 (0.37%)
Polyps\retention cyst	3 (1.14%)
Cancer thyroid	1 (0.37%)
Pituitary macroadenoma	1 (0.37%)
Lymphadenopathy	1 (0.37%)
Total	266 (100%)

Table 3. Distribution of incidental extraspinal pathological findings According To Gender.

	Male n (%)	Female n (%)
Thyroid nodules	2 (12.5%)	14 (87.5%)
Mucosal thickening in Paranasal sinuses	6 (85.72%)	1 (14.28%)
Thyroid goiter	4 (33.33%)	8 (66.67%)
Tornwaldt cyst	2 (100%)	0 (0%)
Cystic hygroma	1(100%)	0 (0%)
Colloid cyst	0 (0%)	1 (100%)
Polyps\retention cyst	2 (66.67%)	1 (33.33%)
Ca thyroid	0 (0%)	1 (100%)
Pituitary macro adenoma	0 (0%)	1 (100%)
Lymphadenopathy	1(100%)	0 (0%)
TOTAL	18 (40%)	27 (60%)

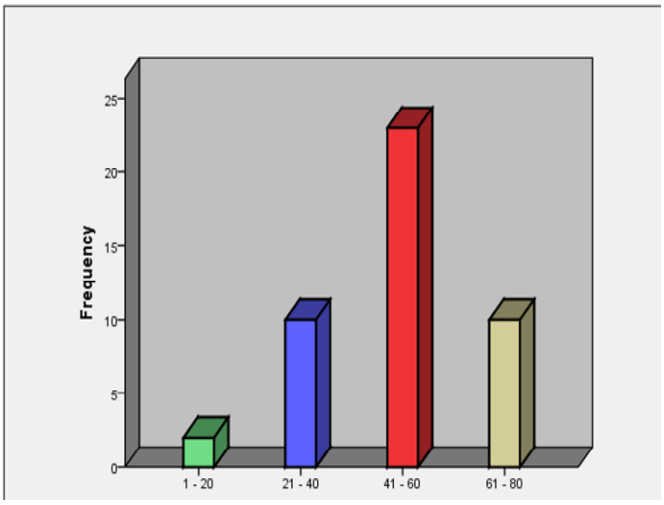

Figure 1. Distribution of incidental extraspinal pathological findings According To age groups.

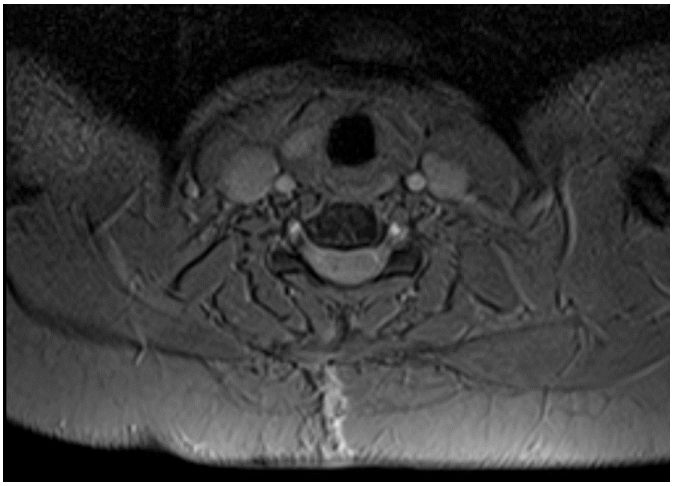

Figure 2. Right lobe thyroideal solitary nodule. The nodule is slightly hyperintense. Thyroid morphology is normal; light size increase of right lobe. Signal of remaining glandular tissue is relatively homogenous.

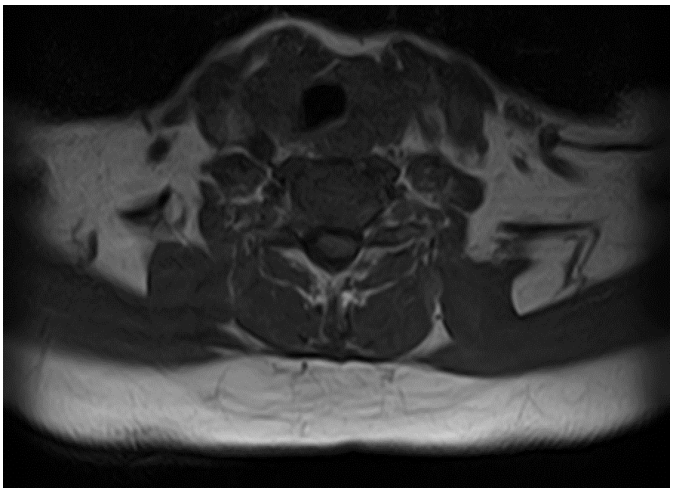

Figure. 3. Thyroid with slight dimensional increase, but relatively homogeneous Goiter.

DISCUSSION

The discovery of incidental findings is and always has been a part of practicing medicine. An incidental finding is asymptomatic Findings may be found while examining a patient for an unrelated reason. The impact of finding incidental findings on patient health outcome is not certain (Westbrook et al., 1998), but it is worth remembering that an incidental finding may be more significant than the suspected disease that prompted imaging (Kamath et al., 2009).

In the current study, 266 patients were examined and 45 patients had incidental findings as shown on table (1) some of these findings were not significant clinically, while other findings were important and early detection of them may lead to decrease morbidity and mortality rates.

These findings were commonly seen at thyroid gland and paranasal sinuses.

Also it was seen in female more than male (Table 3).

Thyroid nodules are one of the most common endocrine diseases in the world. They affect approximately 4 to 7% of the population in iodine-sufficient areas, with a markedly increased incidence in iodine-deficient regions (Maia and Zantut-Wittmann, 2012).

The incidence of thyroid nodules in this study was 6.30 % (n=16), and there were differences according to gender and age groups in terms of incidence.

Thyroid nodules >1 cm were found in 56% of this population and 93.7% of thyroid nodules were solitary nodules and 43.8 % founded in left lobe , 50% in right lobe and 6.2% in both lobes. C. Ottonello (Ottonello et al., 2014) reported that the thyroid nodules were found in 33% of 96 278 working adults aged 18-65 years screened by an ultrasound scan.

Thyroid nodules >1 cm were found in 12% of this population and increased with age. In patients with a single palpable nodule, 20-48% had additional nodules as detected by ultrasonography. Gopinathan Anil et al reported that the prevalence of thyroid nodules is high with multiple thyroid nodules seen in 37.3% and solitary nodules found in 12.2% of random autopsies (Anil et al., 2011).

Thyroid goiter is an abnormally large thyroid gland. A goiter develops either because the whole gland is swollen or the gland has multiple growths or nodules on it. While some people with a goiter have no symptoms, others may have symptoms of an overactive or underactive thyroid (Brady, 2015).

In this study, the detected of thyroid goiter had no relation with the symptoms of the patients. The incidence of the thyroid goiter in this study was 4.6 % (n=12), diffuse goiter was more prevalent than multinodular goiter and thyroid goiters were predominantly in the female population ($p < 0.005$), the ratio women: men ratio in this study were 2:1 and incidence of thyroid goiter increase with age. In previous studies, C. Ottonello reported that the prevalence of diffuse goiter decreases with age, with greatest prevalence in pre-menopausal women; the ratio women: men is at least 4:1 (Ottonello et al., 2014) this findings is different from this study.

Mucosal thickening in paranasal sinuses in this study was observed an incidence of mucosal thickening in paranasal sinuses 2.68% (n=7) and were observed More frequently in men than in women. This result is similar to the result reported by Aleksander Grande et al 2014 (Aleksander et al., 2014) and the prevalence of mucosal

thickening increased with age.

Tornwaldt cyst or Thornwaldt cyst or nasopharyngeal cyst represents the remnant of notochord (Baisakhiya et al., 2011).

Tornwaldt cyst are rare, small in size and asymptomatic, usually diagnosed as an incidental finding on MRI. Large cyst commonly presents with obstructive symptoms. Tornwaldt cysts occur in the midline bursa of the nasopharynx above the upper border of the superior constrictor muscle.

This study, showed an incidence of Tornwaldt cyst 0.76% (n=2), Alper Dilli et al (Dilli et al., 2014) reported that the Tornwaldt cyst was found in 3% of 237 patients were conducted by evaluating a total of 237 MRI examinations of intervertebral discs.

Cystic hygroma, Hygroma in Greek means water-containing tumor. They are congenital malformations of lymphatic system. Cystic hygroma occurs more frequently as compared to other types of lymphangioma, and may compose of single or multiple macrocystic lesions (Mirza et al., 2010).

The incidence of Cystic hygroma in this study was 0.37 %, (n=1)

Colloid cysts or cystic colloid nodule are composed of irregularly enlarged follicles containing abundant colloid (Weerakkody, 2008). The incidence of colloid cysts in this study was 0.37%.

Polyps\retention cyst, the paranasal sinuses are air-filled cavities covered by a thin mucous membrane that adhere to the periosteum. Retention cysts in paranasal sinuses are common, incidental finding at radiographic examinations and are reported to occur in between 1.4% to 9.6% of the general population1. Most mucous retention cysts (MRC) are asymptomatic (Bal et al., 2014).

The incidence of Polyps\retention cyst in this study was 1.14%, (n=3) And were observed Polyps\retention cyst more frequently in men than in women and this results similar with results reported by Aleksander Grande et al 2014 (Aleksander et al., 2014).

Tarp et al. (Tarp et al., 2000) reported polyps and cysts in 15% of participants and found that the majority of them were located in the maxillary sinuses. The lower frequency found in this study can be explained by the fact that we did not measure polyps and retention cysts even when opacifications of either of the other two groups were present, whereas Tarp et al. noted only the most pronounced abnormality of paranasal sinuses .

Thyroid cancer is a common endocrine malignancy that has rapidly increased in global incidence in recent decades (Xing, 2013). The incidence of Ca thyroid in this study was 0.37 %,(n=1)

Pituitary macro adenoma is a benign tumor composed of glandular tissue growth larger than 10 mm (those under 10 mm are called microadenomas). And it is located within pituitary glands (Little, 2016).

The incidence of pituitary macro adenoma in this study was 0.37%, (n=1).

Lymphadenopathy or adenopathy is a disease of the lymph nodes, in which they are abnormal in size, number, or consistency.(18) Lymphadenopathy of an inflammatory type (the most common type) is lymphadenitis, (James, 2017) producing swollen or enlarged lymph nodes (James, 2017).

The incidence of Lymphadenopathy in this study was 0.37%, (n=1). A retrospective study by Frager et al (Frager et al., 1986) of 1517 lumber CT examinations showed that the extra spinal pathology was demonstrated in 22 (1.45%) including retroperitoneal tumors and lymphadenopathy. This result was slightly near to this study.

In this study there was significant relation of the prevalence of incidental finding in older age groups i.e. and we noticed that the age group was the higher rate of incidental findings , and this could be due to increasing incidence of diseases with increasing age. This age –specific effect for incidental finding in consistent with two another study one done on incidental finding on brain MRI done by illes et al (Illes et al., 2004) and the anther one on incidental findings of spinal MRI done by salam M.joori (Salam et al., 2013).

CONCLUSION

In conclusion, an MRI examination of intervertebral discs, paying attention to incidentally detected pathological extraspinal findings is very important due to the fact that they can alter the treatment of the patient or affect the patient's life. Therefore, they should be included in the reports since they will give additional and valuable information.

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