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Role of Elastography in Ultrasound Evaluation of Thyroid Nodules

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Abstract: ***Background: Ultrasound is the modality of choice for evaluation of thyroid nodules. Elastography plays a complimentary role in characterizing the thyroid nodules. Objectives: This study is undertaken to evaluate the role of Elastography in evaluation and characterization of the thyroid nodules. Materials and methods: Fifty cases of thyroid nodules who underwent ultrasound evaluation during March 2016 to march 2017 were included in the study. Elastography was performed during the same sitting. Ultrasound guided FNAC was performed for cytological correlation. Results: Out of the 50 patients 80% were females and 20% were males. Forty two cases were benign on FNAC and 35 of these were seen in females. Eight cases were malignant nodules. Out of the eight cases which were diagnosed as malignant, marked hypo-echogenicity, micro-calcification, intrinsic vascularity and elastography features were found to be useful in differentiating benign from malignant lesions. The sensitivity and specificity of elastography (strain ratio) was 62% and 93% respectively. The p value was highly significant (p<0.010). Conclusions: Ultrasound and elastography are very useful tools in evaluation and characterization of thyroid nodules. Ultrasonography guides the suspicious nodule to be biopsied and thus helps in avoiding unnecessary biopsies.***

Keywords: Thyroid, Nodules, Doppler, Elastography, FNAC

1. Introduction

Thyroid nodules are commonly detected in clinical practice. Being a superficial organ, it is amenable for detailed sonographic evaluation. High resolution ultrasonography is a sensitive imaging test for the detection and characterization of thyroid nodules [1]. Sonography is an economical, easily accessible and repeatable imaging tool for the evaluation of thyroid gland [2]. Unlike nuclear medicine, it has got the advantage of not subjecting the patient to ionizing radiation. Sonography also helps as a guidance tool to biopsy the suspicious lesions [3].

Sonoelastography is a non invasive technique for imaging the stiffness / elasticity of the tissues by measuring the deformation of the tissue in response to applied pressure [4]. It is almost like virtual palpation of the lesions. It quantifies the hardness of a thyroid lesion in relation to the surrounding tissues and thus helps in differentiating benign from malignant lesions. The stiffness of the nodule is dependent on its cellularity. The hardness can be color coded and visually depicted. The strain ratio quantitatively assesses the stiffness of the nodule. The ultrasonography features along with elastography help in characterization of thyroid nodules [4]. The role of elastography is not only limited to confirm the malignant nodules but also to detect those occult nodules which may harbor malignancy [5,6].

2. Materials and Methods

This cross sectional study was performed in the department of radiodiagnosis, JSS Medical college, Mysore from March 2016 to March 2017. Fifty cases of thyroid nodules diagnosed on ultrasonography were included in the study. Informed consent was obtained in proper format. Clearance from ethical committee of the institute was obtained. These patients underwent gray scale sonography, color doppler study, sono elastography and guided FNAC using Philips IU22 ultrasound scanner.

Inclusion Criteria:
Patients with thyroid nodules on clinical examination.
Patients with thyroid hormone abnormalities with nodules on sonography.

Exclusion criteria:
1) Lesions with more than 50% cystic degeneration.
2) Lesions less than 10mm in size.
3) Lesions very close to neck vessels.

Technique:
The patient was placed in Rose position with pillow under the shoulder. Gray scale thyroid gland evaluation was performed using linear transducer of frequency 10-12 MHz.

Sonoelastography was performed using the same transducer. The amount of pressure applied was just sufficient to compress the nodule. When the pressure indicator moved above 50% of the scale provided, elastography series was obtained. Strain ratio of >2.5 was considered as malignant. The other features of malignancy were calcifications, marked hypoechogenicity, incomplete peripheral halo and cervical lymphadenopathy. The nodes with round shape, loss of hilum and size >10mm were considered as metastatic [7].

FNAC of the nodules was performed under sonographic guidance, using a 23G needle. Cytological results were reported according to the Bethesda classification. It included the following categories:
1. Non diagnostic or unsatisfactory,
2. Benign,
3. Atypical cells of uncertain significance,
4. Suspicious of follicular neoplasm,
5. Malignant.

3. Results

Age & Sex distribution:
The age group of our study population ranged from 20-75years. Most of the patients in this age group were between 35-50 years (55%).

Fifty patients were evaluated in the present study. Out of the 50 patients, 40 were females (80%) and 10 were males (20%). Forty two cases were benign on FNAC and 35 of these were seen in females. The incidence of benign nodules in male patients was 17%. Eight cases in our study were malignant nodules, out of which 5 were found in males (63%) and 3 in females (38%).

Echogenicity:
Fifty percent of the cases (25 cases) showed echogenic nodules, 30% (15 patients) had hypoechoic nodules and 10% (5 patients) had mixed echogenic nodules. Out of the eight cases which were diagnosed as malignant nodules, 88% (7 cases) were markedly hypoechoic. There was no hyperechoic nodule with malignancy in our study. In nodules of mixed echogenicity, one patient had malignancy.

Calcification:
Out of the 50 cases, fifteen showed calcification (30%). Out of them, 10 cases (67%) showed macrocalcification and 5 (23%) showed microcalcification. All the cases with macrocalcification were found to be benign in our study. Among the 5 cases with microcalcification, 3 cases (60%) were malignant and the rest were benign.

Vascularity:
Out of the 50 cases, 35 cases (70%) showed peripheral vascularity. Both peripheral and intrinsic vascularity was seen in 15 (30%). All the nodules with peripheral vascularity were found to be benign on FNAC (100%). Among the nodules with intrinsic vascularity, 5 cases (33%) were malignant and the rest were benign.

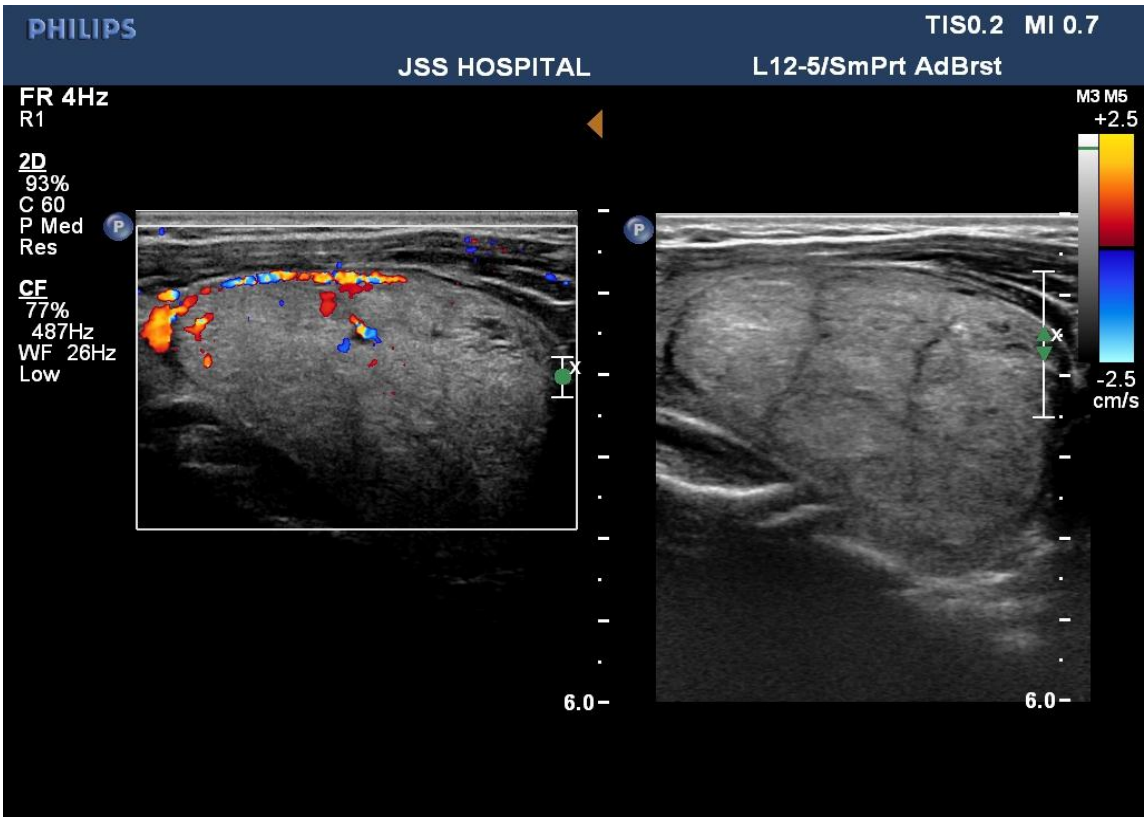

Figure 1: Benign nodule with peripheral vascularity.

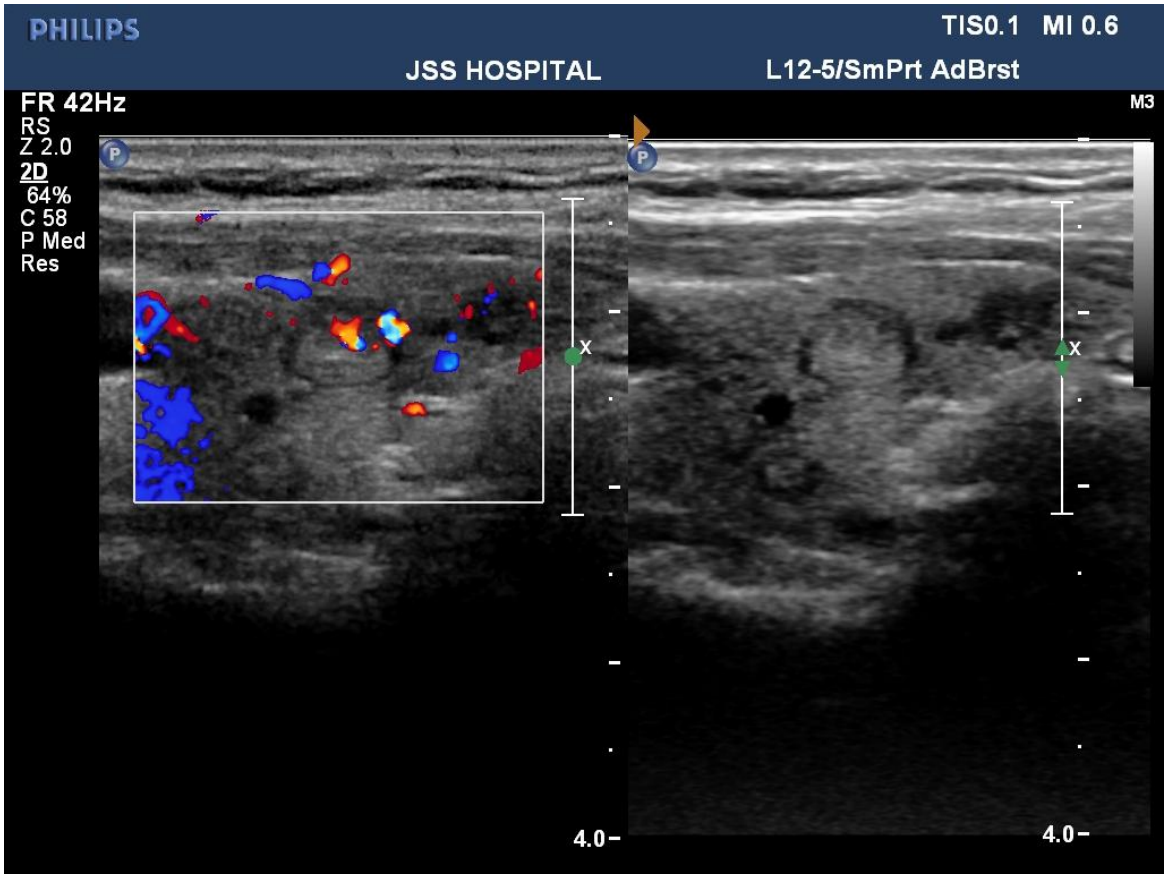

Figure 2: Malignant nodule with intrinsic vascularity

Elastography:
Out of the 50 cases, 8 cases were found to be suspicious of malignancy on strain ratio. Out of this, 5 were (63%) confirmed as malignant on FNAC. The sensitivity and specificity of elastography (strain ratio) was 62% and 93% respectively. The p value was highly significant (p<0.010).

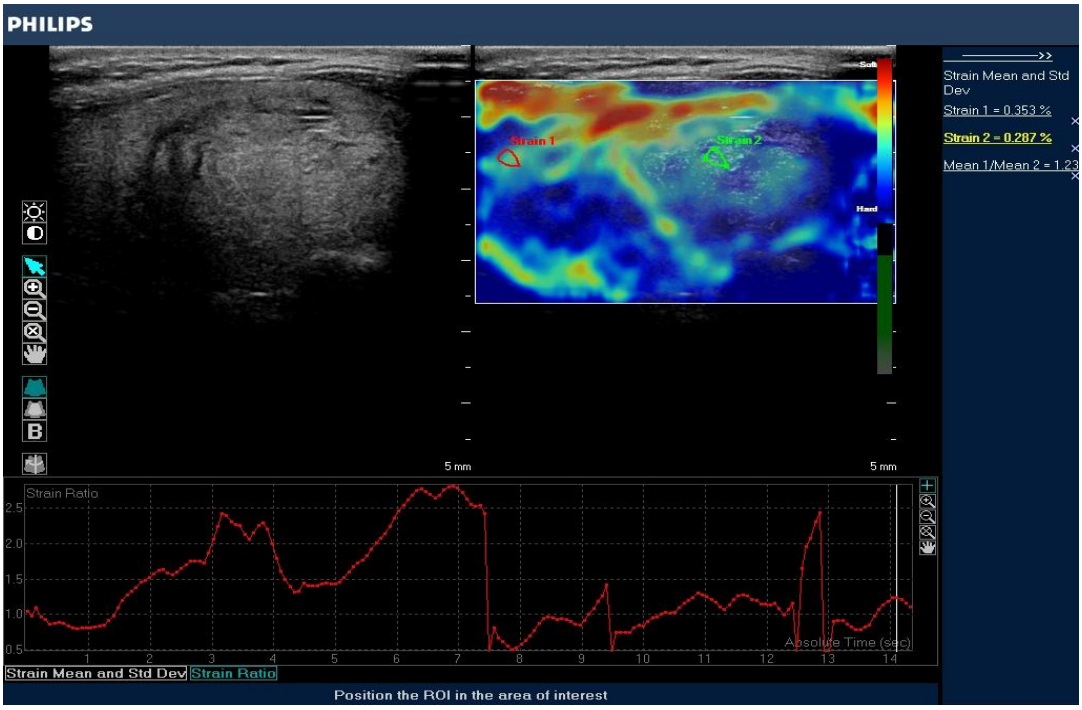

Figure 3: Hyperechoic nodule with grade I elastography (train ratio of 1.23) features - Benign.

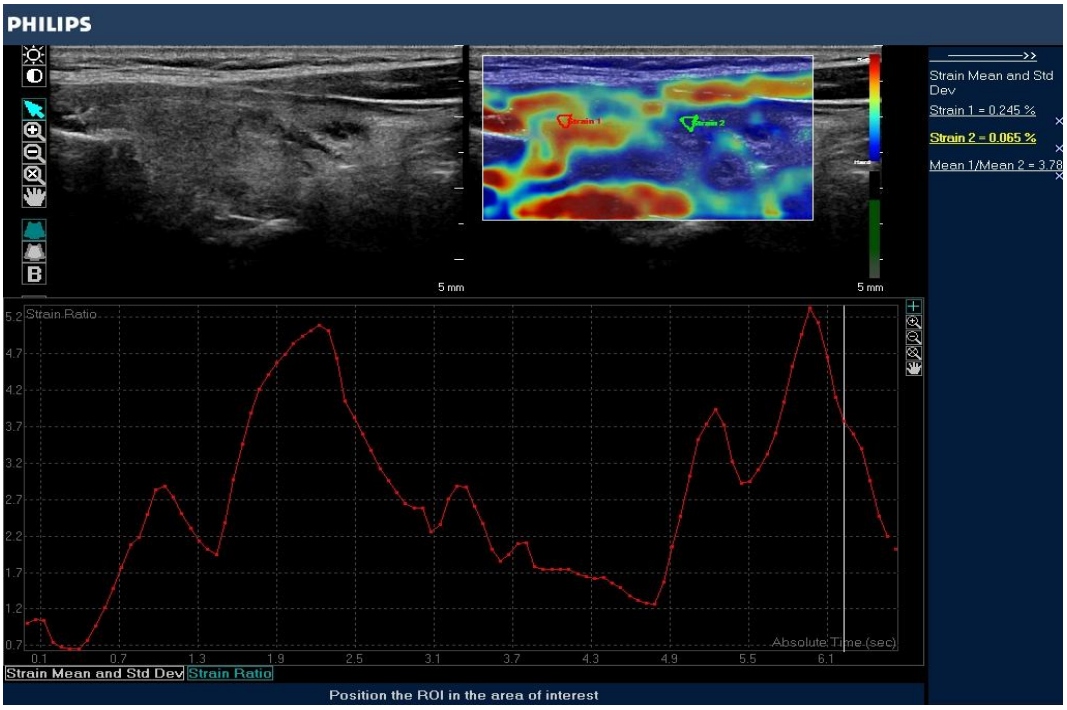

Figure 4: Ill-defined nodule in right lobe thyroid with strain ratio of 3.74 – Malignant

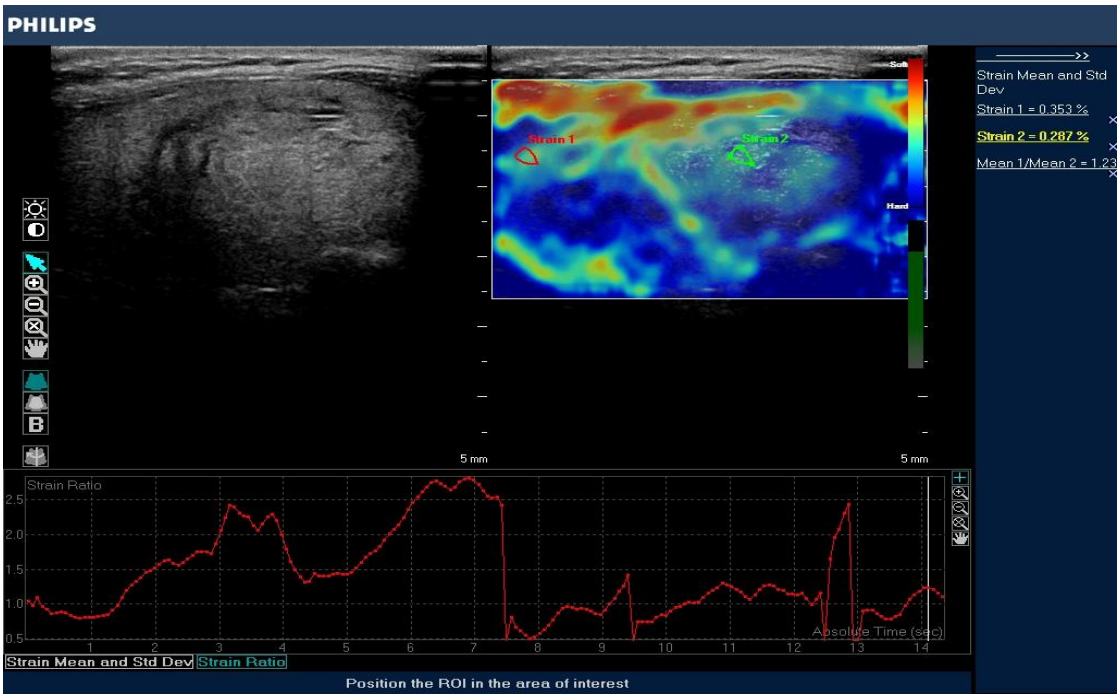

Figure 5: Thyroid nodule with grade III elastography features which turned out to be malignant on FNAC

4. Discussion

Thyroid nodules are common in routine radiology practice. Characterization of these nodules is possible using thyroid ultrasonography, color doppler study, elastography and FNAC. The nodules which are to be biopsied are suggested by suspicious features on sonography. FNAC was considered as the diagnostic standard in our study.

The age group of our study population ranged from 20-75years. Most of the patients in this age group were between 35-50 years (55%). Fifty cases of thyroid nodules were studied. Out of the 50 cases, 8 cases showed malignant nodules (16%) and the rest were benign nodules. All the patients with malignant nodules were above 40 years of age. Out of the 8 malignant cases, 5 nodules (63%) were found in males and 3 (38%) were found in females.

Conversely, of the 42 benign cases, 35 (83%) were found in females and the rest 17% were found in males. Thus, in our study, majority of malignant nodules were found in males and benign nodules were found in females. This is in accordance with the study of Tuttle et al [8]. The hypoechogenicity was decided in our study by comparing the echogenicity of the nodule with the echogenicity of the strap muscles. This is in accordance with the study of Park et al [9].

In our study, 25 cases (50%) showed echogenic nodules, 15 patients (30%) had hypoechoic nodules and 5 cases (10%) had mixed echogenic nodules. Out of the eight cases which were diagnosed as malignant nodules, 88% (7 cases) were markedly hypoechoic. This is in accordance with the study of Won Jin Moon et al, according to which hyperechoic nodules are usually benign [10]. Most of the markedly hypoechoic nodules turned out to be malignant in a study conducted by Kim et al [11]. In our study also, all the malignant nodules were markedly hypoechoic. There was no echogenic malignant nodule encountered in our study.

Out of 50 cases, fifteen showed calcification (30%). Out of them, 10 cases (67%) showed macrocalcification and 5 (23%) showed microcalcification. Among the 5 cases with microcalcification, 3 cases (60%) were malignant and the rest were benign. Microcalcifications represent psammoma bodies, which are round, laminar calcific deposits. According to Kim et al, microcalcifications are very specific for malignancy [11]. In our study also, 60% of the cases with microcalcification were malignant.

Out of 50 cases, 35 cases (70%) showed peripheral vascularity and both peripheral and intrinsic vascularity was seen in 15(30%). All the nodules with peripheral vascularity were found to be benign on FNAC (100%). Among the nodules with intrinsic vascularity, 5 cases (33%) were malignant and the rest were benign. The presence of central vascularity in a nodule is a sensitive indicator of malignancy than peripheral vascularity according to Frates and chan et al [12,13].

Out of the 50 cases, 8 cases were found to be suspicious of malignancy on strain ratio. Out of this, 5 were (63%) confirmed as malignant on FNAC. The sensitivity and specificity of elastography (strain ratio) was 62% and 93% respectively in our study with highly significant p value ($p<0.010$). Chong et al found that strain ratio of higher than 3.1 is highly suggestive of malignancy [14]. We used strain ratio of 2.5 as the cut off. However, some of the malignant nodules like papillary carcinoma showed lower elasticity and still were malignant [15, 16]. This may require evaluation of large number of patients to arrive at a conclusion.

5. Conclusion

As multiplicity is common in thyroid nodules, all the nodules can not be biopsied or aspirated for histological diagnosis. Hence, a method of non invasive characterization of the thyroid nodules into benign and malignant categories is required. Ultrasonography is a cost effective and versatile modality to evaluate the thyroid nodules. Marked hypoechoigenicity, intrinsic vascularity and microcalcifications favour malignancy. Sonoelastography helps in characterization of the nodules by using the strain ratio. It has high sensitivity and specificity comparable to FNAC.

References

[1] Nobuhiro Fukunari, Mitsuji Nagahama, Kiminori Sugnio. Clinical evaluation of color doppler imaging for the differential diagnosis of thyroid follicular lesions. World Journal of surgery 2004; 28 (12): 1261-65.
[2] J.D Iannucilli, J.J. Cronan, J.M.Monchik. Risk for malignancy of thyroid nodules as assessed by sonorpahic criteria: the need for biopsy. Journal of Ultrasonography in Medicine, 2004; 23: 1455 – 64.
[3] Bojunga J, Hermann E, Meyer G. Real time elastography for the differentiation of benign and malignant thyroid nodules: A meta analysis. Thyroid 2010; 20:1145-50.
[4] J.K. Hoang, K.L Wai, M. Lee, D. Johnson, S. Farrell. US features of thyroid malignancy: Pears and pitfalls. Radiographics 2007;3:847-860.
[5] Tuttle RM, Ball DW, Byrd D. National comprehensive cancer networkdk clinical practice guidelines in oncology: Thyroid carcinoma, Version 2. 2013.
[6] Jang Mi Park, Yoon jung Choi, Hyon Joo Kwang. Partially cystic thyroid nodules: Ultrasound features of malignancy. Korean Journal of Radiology 2012; 13(5): 530-535.
[7] Kim M.J, Kim EK, Kwak JY, Park CS, Chung WY, Nam KH. Differentiation of thyroid nodules with micorcalcifications – role of suspicious sonographic findings. J Ultrasound Med 2008; 27: 1179-84.
[8] Moon WJ, Jung SL, Lee JH, Baek JH, Lee YH. Benign and malignant thyroid nodules: US differentiation-multicentre retrospective study. Radiology 2008; 247:762- 70.
[9] Frates MC, Benson CB, CHarboneu JW et al. Management of thyroid nodules detected at US: Society of Radiologists in ultrasound consensus conference statement. Radiology 2005; 237 (3): 794 – 800.
[10] Chan BK, Desser TS, Mcdougall IR, Weigel RJ, Jeffrey RB. COmon and uncommon sonographic features of papillary thyroid carcinoma. J Ultrasound Med 2003; 22 (10): 1083-1090.
[11] Y. Chong, JH Shin, ES Ko, BK Han. Ultrasonographic elastography of thyroid nodules – Is adding strin ratio to color mapping better ?. Clinical Radiology 2013; 68 (12): 1241 – 46.
[12] Rago T, Santini F, Scutari |M et al. Elastography: New developments in ultrasonography for predicting malignancy in thyroid nodules. J Clin Endocrinol Metab 2007; 92: 2917-2922.
[13] Sachchi M, Andrioli M, Carzangia C et al. Elastography evaluation of thyroid nodules in acromegaly. Eur J Endocrinographic evaluation of thyroid nodules in acromegaly. Eur Endorinol 2009; 161: 607 – 613.
[14] Jeong Hyun Lee, Yoshimi Anzai. Imaging of thyroid and parathyroid glands. Seminars in Roentgenology.2013;87-104.
[15] Gennisson JL, Deffieux T, Fink M, Tanter M. Ultrasound elastography: Principles and techniques. Diagn Interv Imaging 2013 May; 94(5): 487-495.
[16] Mehmet Sait Menzilcioglu, Mahmut Duymus, Serhat Avcu. Sonographic elastography of the thyroid gland. Pol J Radiol, 2016; 81: 152-156.