SCINTIGRAPHIC ANALYSIS OF THYROID DISEASES AT THE LAGOS UNIVERSITY TEACHING HOSPITAL, LAGOS, NIGERIA.

M. A. Aweda,
Department Of Radiation Biology, Radiotherapy And Radiodiagnosis, College Of Medicine/Lagos University Teaching Hospital, P. M. B. 12003, Lagos, Nigeria.
E-Mail: awedama@hotmail.com

ABSTRACT
This paper presents a retrospective analysis of randomly selected clinical scintigraphic records at the College of Medicine/Lagos University Teaching Hospital, Nigeria. Out of the 436 patients scanned for various thyroid abnormalities, 266 (61.0%) were used for the analysis due to insufficient data and parameters required for the analysis in the clinical records. Among these 266 cases selected, euthyroidism showed the highest incidence of 123 (46.2%). This was followed by hyperthyroidism 103 (38.7%) and hypothyroidism 40 (15.1%). Of the 103 hyperthyroidism studied, thyrotoxicosis was noted in 82 cases (79.6%). Grave's disease was found in 11 (10.7%) and Nodular goitre in 10 (9.7%).

ABSTRAIT
Cet article présente une analyse rétrospective des disques scintigraphic cliniques aléatoirement choisis à l'université de la médecineHôpital D'Enseignement D'Université De Lagos, Le Nigéria. Hors des 436 patients a balayé pour différentes anomalies thyroïde, 266 (61.0%) ont été employés pour l'analyse due aux données insuffisantes et aux paramètres exigés pour l'analyse dans les disques cliniques. Parmi ces 266 cas choisis, l'euthyroidism a montré l'incidence la plus élevée de 123 (46.2%). Ceci a été suivi de l'hyperthyroïdisme 103 (38.7%) et de l'hypothyroïdisme 40 (15.1%). De 103 l'hyperthyroïdisme a étudié, le thyrotoxicosis a été noté dans 82 cas (79.6%). La maladie de la tombe a été trouvée dans 11 (10.7%) et goiter nodulaire dans 10 (9.7%).

INTRODUCTION
Thyroid scanning dates back to 1929 when Geiger-Muller counter was invented. The term scan traditionally refers to the imaging of human body in order to portray the anatomy and the physiology, which are essential to the diagnosis and treatment of diseases. There exists a wide spectrum of such diseases typically found in cardiovascular, thyroid and parathyroid systems, gastrointestinal track etc. The first point-by-point image of the thyroid gland was obtained in 1948 (1). Scintigraphic scanning has since then become a well-known technique for thyroid uptake studies, radioimmunoassay of the gland and the study of other endocrine disorders.
The Department of Radiation Biology, Radiotherapy and Radiodiagnosis of the College of Medicine /Lagos University Teaching Hospital in Nigeria has been practicing radioisotopic scanning since 1968. This paper presents a retrospective analytical study of the thyroid scintigraphs in the laboratory using a rectilinear scanner Scintimat II from Siemens. Treated cases of thyroid diseases over a period of time were randomly selected and analyzed to compare and establish the predominant age group and sex and to define the prevalence, clinical presentation and the outcome of the diagnosis of diseases.

INSTRUMENTATION & METHODS
The Scintimat II from Siemens was used for the scintigraphic procedures. The system is an automatic rectilinear scanner with a detector assembly

consisting of a 7.5mm by 5.0mm NaI(Tl) scintillator, a multihole cylindrical lead collimator which has been tapered to converge at a focal point in order to direct the gamma rays, the photomultiplier tube (PMT) with a preamplifier, are well shielded to minimize the influence of background radiation. The detector and the PMT are so connected to ensure good energy resolution and the best optical conditions. The collimators are of various sizes, each adapted for different types of examination with characteristic focal distance, resolution, sensitivity and focal depth of the photon energy. A maximum resolution, sensitivity of 1530 counts / min x cm3 / 3.7 x 10^4Bq and 0.13 counts x mm^2 / quart and a focal distance of 100mm were used with a fine focus of 86 holed collimator for the thyroid scans. A multicolour dot printer provides the information recording on paper with different colours indicating different concentration distribution of the radionuclide uptake. The system is designed for uptake measurements in 2-D scintigraphic image production of different organs. It is capable of thyroid, liver, bone and total body scanning. Typical scans are presented in figures 1 2.

The radiopharmaceutical of choice in 95% of the cases reported was NaI-131 with the characteristic gamma emission of 264KeV and the activity ranging from 1.85 to 3.7MBq. I-123 was not used because of its short $T_{1/2}$. The product was administered orally or intravenously 24 hours prior to scanning. Thyroid function counts were obtained 4 hours, 12 hours and 48 hours after injection.

DATA ANALYSIS

Data were obtained from the clinical records of the patients with thyroid abnormalities. Requests for thyroid radioisotopic scans were received from the managing physician while the final diagnosis was arrived at from a combination of all the clinical findings from blood and urine tests and radiological investigations. The records were categorized as hypothyroidism, euthyroidism and hyperthyroidism. Patients were also classified according to the clinical diagnosis, sex and age groups. The grouping of ages was as follows: 0 12 years as children, 13 25 years as adolescent and above 25 years as adults. This classification conforms with that of Butterworths Medical Dictionary [2] with a slight variation. The classification of diseases adopted is the modified form of Werner's[3]. The authors thought it useful to maintain a distinction between childhood, puberty and menopausal stages. This was however impossible because the clinical records simply present the patient ages as either “children” or “adults” in most cases. Only 266 (61.0%) of the 436 clinical cases randomly selected were used for this study. This is because the other records could not provide sufficient parameters and the variables such as age, sex and clinical prognosis required for the analysis.

RESULTS

40 (15.0%) patients of the analysed cases belong to this category. 32 (80.0%) were predominantly hypothyroid, 7 (17.0%) were cases of cretinism and 1 (2.5%) was of low Intelligence Quotient (IQ). Fig. 3(a) shows virtually similar incidence of hypothyroidism in 16 (50.0%) adults and in 15(46.9%) children. Tables 1(a) and 2(a) show the overall statistics of the occurrence in different age groups and gender. Hypothyroidism occurs more frequently in childhood but has equal probability of occurrence among males and females.

EUTHYROIDISM

This accounted for 123 (46.2%) of the cases. The high percentage could be attributed to the fact that patients with Grave's disease become euthyroid or hyperthyroid after medical, surgical or

radioiodine therapy (8). Table 1(b) shows the frequency of occurrence with the simple goitre dominating, having 49 (39.0%) cases, thyroid swelling 26 (21.0%), non-toxic goitre 22 (17.9%), thyroid carcinoma 6 (5.0%), thyroiditis 2 (1.6%), thyroglossal cyst 2 (1.6%) and non-classified euthyroid 16 (13%) cases. Out of the 49 simple goitre patients, 44 (90.0%) occurred in adults and the rest 5 (10.0%) in adolescents with no single record in children below 12 years.

A total of 104 (85.0%) of the disease conditions were diagnosed among females. As shown in table 1(b) and in fig 4(b), except the thyroglossal cyst and thyroid carcinoma, all others show prevalence in females. Fig 5(b) clearly demonstrates that euthyroidism is a prevalent condition among adult females. Adolescents showing indication of abnormal thyroid in this category are significantly females as could be seen in table 2(b). Although there is a marked similarity in the distribution of thyroid carcinomas between genders (ratio 1:1), it occurs mainly in adulthood.

HYPERTHYROIDISM

This was recorded in 103 (38.7%) cases. Thyrotoxicosis was noted in 82 (79.6%) cases. Grave's disease in 11 (10.7%) and nodular goitre in 10 (9.7%) cases. There was loss of weight in 2 patients. Fig 4(c) show an overriding incidence of thyrotoxicosis among adults 7(70.9%) compared to a rather low 3 (2.9%) cases in childhood and a complementary increase in adolescents 6 (5.8%). This trend is in agreement with the separate reports by Perrild et. Al[9] and Witte et al.[10] that thyrotoxicosis in childhood and adolescent is rare and most frequently due to Grave's disease. It is predominantly expressed in females 66 (80.5%) as seen in fig 4(c). No case of Grave's disease was recorded in children in this study and only one incidence (9.0%) was found in adolescents, and 10 (91.0%) in adults. Grave's disease is dominant in females 8 (72.7%) which agrees with Ghada Haddad[6] , who attributed the prevalence to other autoimmune diseases. Nodular goitre is predominant among adults 8 (100.0%). Fig 5(c) shows the distribution of hyperthyroidism among classified age groups and in relation to gender. It indicates a sizeable incidence in female adults and slight indications in adolescents and children.

DISCUSSION

Hypothyroidism accounts for 15.0% of the cases studied. Generally, primary and secondary hypothyroidisms characteristically produce decreased iodine uptake. Primary hypothyroidism is a failure of the gland to respond to thyroid stimulation hormone (TSH), whereas secondary hypothyroidism is due to insufficient pituitary secretion of the TSH. However because of the recent decrease in the uptake resulting from increased dietary iodide, it is becoming increasingly difficult to use the iodine uptake as indication for hypothyroidism. Ectopic thyroid tissue could be demonstrated only by scintigraphiy where clinical examinations and ultrasonography fail in the diagnosis of congenital hypothyroidism[8] . Cretinism is noticeably the sole contributor to hypothyroidism in childhood. Karlson et. al. have suggested thyroxin replacement therapy in hypothyroid children to prevent the development of a more severe hypothyroidic state[9] . Low growth rate in prepubertal parents with the disease has also been reported. This agrees with the findings in our study. Within the two genders in fig 3(a), a noticeable difference in the incidence is observed with the female gender dominating 22 (69.0%) over male 10 (31.0%), although cretinism appears to be prevalent in males 5 (71.0%) when compared to females 2 (29.0%). Dent et. al. in their survey of the incidence and the size of endemic goitres in Harare,

claimed that there is no significant difference in the incidence with age[10] . This claim is however contrary to our findings with 5 (10.0%) and 3 (14.0%) of the goitres and non-toxic goitres respectively in adolescents and much as greater percentage in adults. This claim could however be explained by the fact that their studies were restricted to ages between 9 and 15 years, which is insufficient to make such generalised claim. Their results on the incidence among the genders 63.0% male and 80.0% female however compare favourably with ours in table 1(b) and fig 4(b). A critical study of fig 3(b) reveals a unique similarity in the trend followed by the distribution of the incidence of the disease condition i.e. increased incidence from childhood to adolescent, and the highest incidence in adults. The only exception to this trend is the thyroid swelling which affects more children 3 (11.0%) than the adolescents 1 (4.0%), and an upsurge of incidence in adults 22 (85.0%). Marked similarity n the distribution of thyroid carcinomas between genders occurs in adulthood.. This observation agrees totally with Danase et al.[11] who declared a prevalence in females with a ratio ranging from 3 to 8:1. They also claimed that childhood accounts for about 13% of all thyroid cases. The difference in our results may be due to the low number of thyroid carcinomas in this study, which in not adequate to draw any valid conclusion on the prevalence of the disease. Hyperthyroidism, which represents 38.7% of studied cases, may be due to diffuse toxic goitre (Grave's disease), toxic nodulal goiter or single toxic nodule (Plimmer's disease). Radioiodine uptake study as an aid to calculating the therapeutic dosage is becoming less frequently practiced according to Lazarus[12] . Grave's disease is usually diagnosed clinically by scintigraphy, but where there is doubt, ultrasound may occasionally be used in confirming that the gland is the seat of a diffuse rather than a nodular process. Scintigraphy reveals homogeneous uptake in an enlarged gland, which differentiates Grave's disease from toxic nodular goitre. Toxic nodular goitre scintigraphy reveals an increased uptake in a single or multiple nodules with partial or complete suppression of the remaining thyroid tissue. The importance of multinodularity is in relation to the risk of malignancy. It has been said that the chance of malignancy arising in a multinodular gland is low, of the order of 1 to 4 %. Whereas the chance in a truely solitary is 10 25% (14, 15). However, the former figure was arrived at using clinical examinations and scintigraphy. It is now known that there are multiple nodules present in the thyroid glands of 20 to 40% of parents presenting with a clinically solitary lesion[16] . Solitary nodule is a controversial topic and a common clinical problem. Palpable nodules have been reported in 15% of the population with solitary nodules present in 3.2% of women and 0.8% of men[17]. The overall likelihood of malignancy in a solitary thyroid nodule is significant and is about 10%[18] . Ideally, imaging should enable us to identify 10% of nodules, which are malignant, avoiding the removal of the other 90%. Ultrasound has a limited role in the initial evaluation of thyroid nodules, but it is important in following both benign and malignant lesions, to monitor lymph node spread and thyroid bed recurrence[19] .

The role of scintigraphy in the investigation of solitary thyroid nodules is changing. Hypofunctioning (cold) nodules are dangerous and should be removed or at least biopsied. Malignancy is rare in nodules showing uptake of radiopharmaceuticals and autonomous functioning nodules are almost never malignant. There could be equivocal results on whether a nodule is truly hot or just warm, (i. e. uptake of the same order as the surrounding normal thyroid

tissues). Although this difficulty can be resolved by rescanning the patient after the administration of triiodothyronine to see if the activity of the nodule is suppressed, this is seldom done in practice.

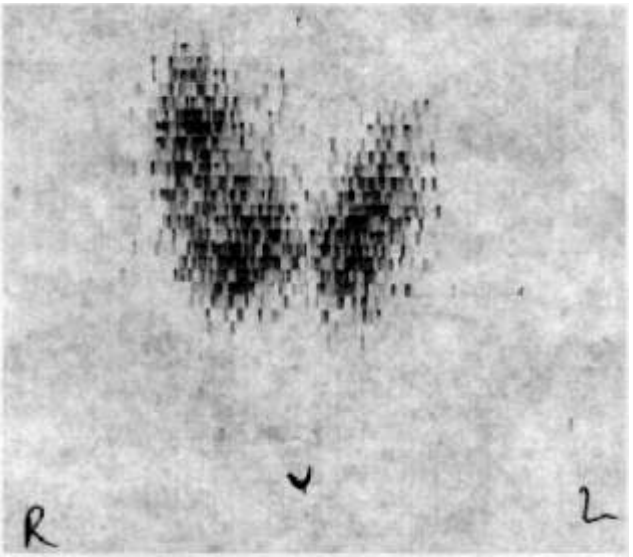

Fig 1 Thyroid Carcinoma involving the left laba

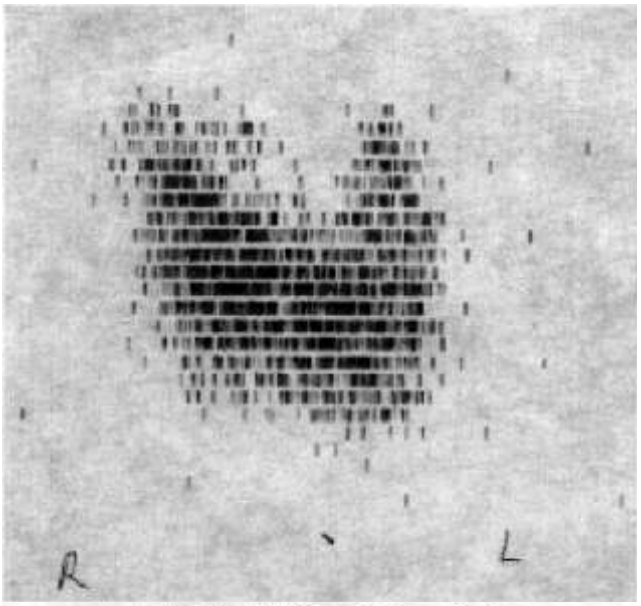

Fig 2:- Thyroid with Grave's disease showing characteristic pattern of uniform distribution within an enlarged gland.

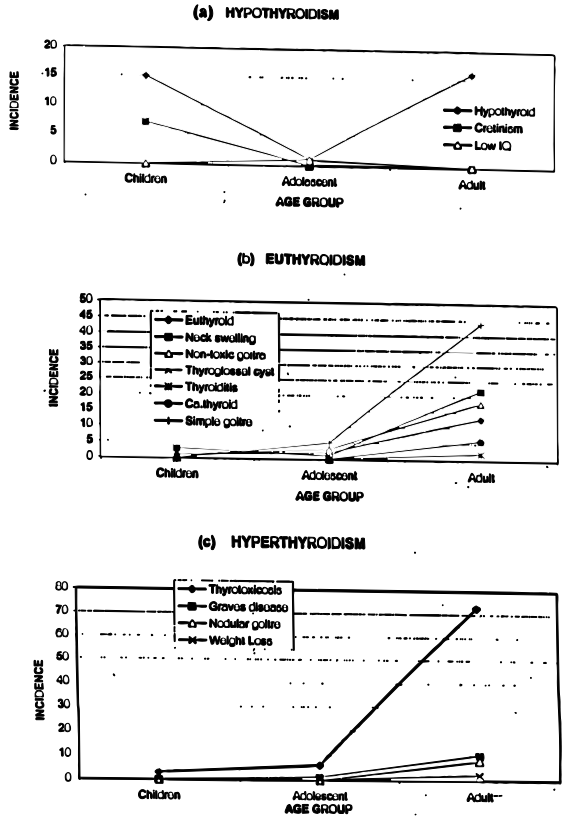

Figure 3 Graph showing Incidence of thyroid abnormalities Hypothyroidism, Euthyroidism and Hyperthyroidism among age groups

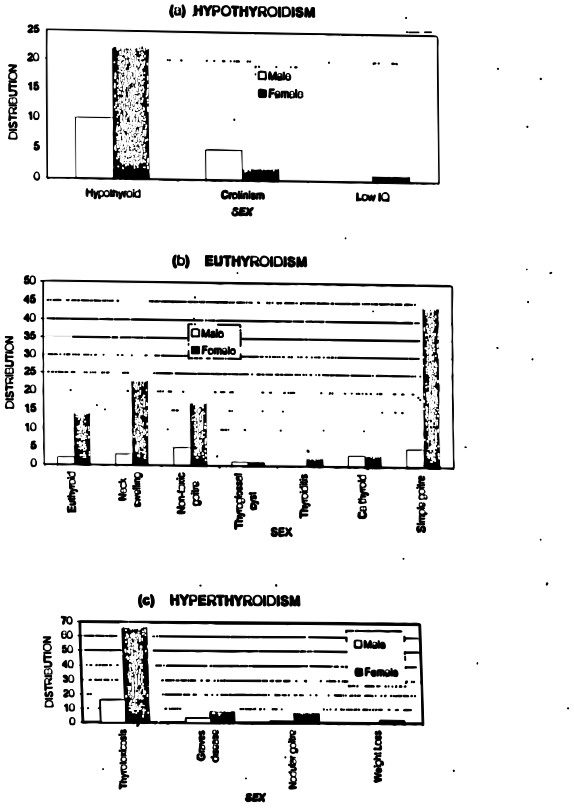

Figure 4: Histogram distribution of thyroid abnormalities characterised: Hypothyroidism, Euthyroidism and Hyperthyroidism in the sexes

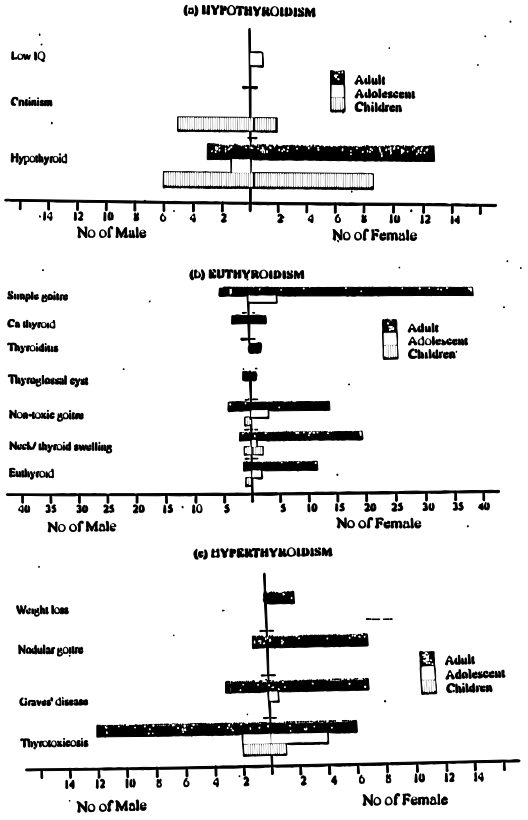

Figure 5 Histogram showing the distribution of Hypothyroidism, Euthyroidism, and Hyperthyroidism conditions among age groups in relation to gender

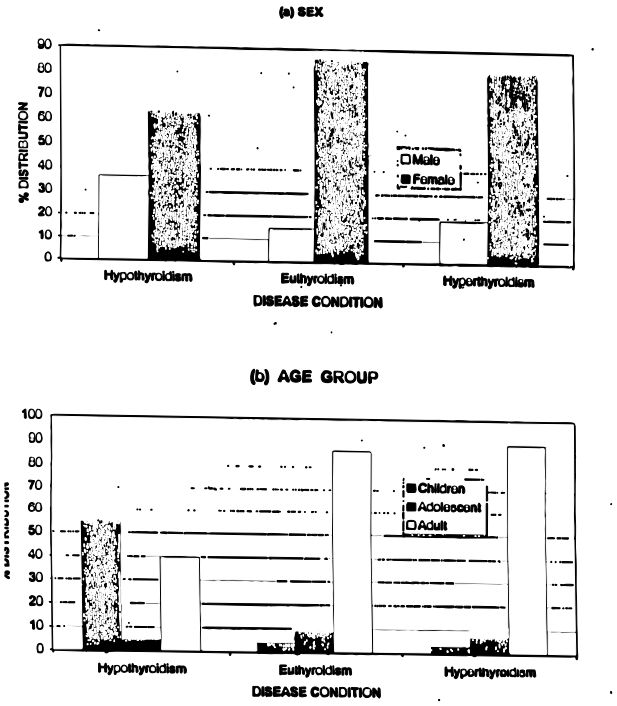

Figure 6 Distribution of Hypothyroidism, Euthyroidism and Hyperthyrodisim in (a) Sexes and (b) age groups

REFERENCES

1. Ansell G, Rotblat J. "Radioactive Iodine as a Diagnostic Aid for Intrathoracic Goitre". Brit. J. Radiol. 1948; 21: 552-558.
2. Butherworths Medical Dictionary. McDonald C. Editor-in-Chief. Butherworths and Co. Pub. Ltd. 1990 Edition.
3. Werner SCJ. "Report of the Committee on Nomenclature: American Thyroid Association" J. Clinc. Endocrinol. 1969; 29:0860-862.
4. Freeman AG "Gross Digital Clubbing and Exophthalmic Ophthalmophegia in Thyroid Disorder". Lancet. 1958; II: 57-60.
5. Perrild A, Lavard J, Brock-Jacobson B. "Clinical Aspect and Treatment of Juveri Grave's Disease" Exp. Clin. Endocrinol. Diabet. 1997; 105: 4 pp 55-57.
6. Ghada Haddad M. D. "Is it Hyperthyroidism? You Can't Always Tell from the Clinical Picture" Postgrad. Med. J.1998;104: 42-55
7. Klett M. "Epidemiology of Congenital Hypothyroidism" Exp. Clin. Endocrinol. Diabet. Supplem 4 1997; 105: 19-23.
8. Meller J, Zappel H, Conrad M, Roth C, Emirich D, Becker W. "Diagnostic Value of I-123 Scintigraphy and Perchlorate Discharge Test in Diagnosis of Congenital Hypothyroidism". Exp. Clin. Endocrinol. Diabet. Suppl. 4 1997; 105: 24-27.
9. Karlsson B, Gustafsson J, Hedov G., Ivorsson S A, Anneren G. "Thyroid Dysfunction in Down's Syndrome. Relation to Age and Thyroid Autoimmuneity " Arch. Dis. Child. 1998; 79: 242-245.
10. Dent JN, Gasden EL, Furth J. "A Survey of the Incidence and Size of Endemic Goitre in Harare" The Central Afric. J. Medicine. 1965; 174-185.
11. Danase D. "Thyroid Carcinoma in Children and Adolescents" Euro. J. Paediatri. 1997; 156(3): 190-194.
12. Lazarus JH. "Guidelines for the Use of Radioiodine in the Management of Hypothyroidism: A Summary" J. Royal College of Physicians of London 1995; 29: 464-469.
13. Price DC. Radioisotopic Evaluation of the Thyroid and Parathyroids" Radiol.Clinic. Of North America 1993; 31: 991-1015.
14. Messaris G, Kyriakou K, Vasilopoulos P. "The Single Thyroid Nodule and Carcinoma" Brit. J. Surgery. 1974; 16: 943-944.
15. Brooks JR. "The Solitary Nodule" Americ. J. Surgery. 1973; 125: 477-481.
16. Scheible W, Leopold GR, Woo V L, Gosink BB. "High Resolution Real Time Ultrasonography of Thyroid Nodules" Radiology 1979;133: 413-417.
17. Tubridge W, Evered DC, Hall R, Appleton D, Brewis M, Clark F, Evans JG, Young E, Bird T, Smith PA. "The Spectrum of the Thyroid Diseases in a Community. The Wickham Survey" Clin. Endocrinology 1977; 7: 481-493.
18. Rokeski M. T. and Gharib H. "Nodular Thyroid Disease: Evaluation and Management" New England J. Med. 1985; 313: 428-436.
19. Ross D. S. "Evaluation of the Thyroid Nodules" J. Nucl. Med. 1991; 32: 2181-2192.