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FINAL REPORT OF THE RESEARCH WORK

'ULTRASOUND IN THE DIAGNOSIS OF THE NECK MASSES'

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INTRODUCTION

The role of USG in evalution of neck region is becoming increasingly important due to the availability of high – frequency (7.5 to 15 MHZ) probes, which permit visualization of more subtle anatomical and pathological details. Some anatomical landmarks must be summarized to understand the possibilities and limitation of USG in pathological condition. Each half of neck is divided by sternocleidomastoid muscle into a posterior triangle containing mostly muscles and fasciae and an anterior triangle.The latter includes a lateral part (carotid region) and a medial part divided by hyoid bone into suprahyoid and infrahyoid region . The upper part of carotid region is located lateral to the pharynx; the lower part includes the common carotid artery, the internal jugular vein, and four cranial nerves from IX to XII. The larynx is not usually a major area of interest in the sonographic investigation of neck. However, if the thyroid cartilage is not calcified, with high resolution transducers, the structures surrounding the laryngeal cavity and the vocal cords can be visualized.

In the suprahyoid region, the most important anatomical structures are the submandibular gland and some muscles (digastric, hyoglossus, stylohyoid). Many structures are located in the infrahyoid region. Just behind the subcutaneous plane, the platysma muscle, cervical fascia, and the strap muscles with median raphe are visible. Posteromedial to the thyroid lobes, the longus colli muscle and esophagus (on left side) are located. Each thyroid lobe has two arteries: superior and inferior. A third vessel, the median artery, can infrequently be present. Normal thyroid arteries are approximately 1 to 2 mm in diameter. Three groups of thyroid veins (superior, inferior and middle) originate from the perithyroid network and have variable number and course. USG can demonstrate most of these branches.

The thyroid gland is located in the anterior part of neck with the lateral lobes lying on either side of the trachea, connected by isthmus across the midline. In a variable percentage of normal individuals (10 to 40 %), a third thyroid lobe (pyramidal lobe) can be found extending upward from the isthmus to suprahyoid region. Both longitudinal and transverse scans are used to survey the entire gland. Thyroid lobes have an oval shape with a rounded inferior pole and an elongated upper pole. Dimensions of normal thyroid may vary greatly, according to constitutional habit. In thin individuals, the length of lateral lobes may reach 7 to 8 cm, and the thickness may not exceed 1 cm whereas in obese individuals the thickness can reach up to 2 cm. The thickness is the most reliable diameter to consider in evaluation of thyroid size. If this value exceeds 2 cm, a gland enlargement can be diagnosed confidently. The normal thyroid echotexture is homogenous, with vascular structures mainly at poles. A thin hyper echoic capsule surrounds the gland. Focal alterations of parenchyma pattern like small (2to3mm) anechoic areas representing colloid collections, isolated calcifications, and hyperechoic linear bands of fibrous tissue are frequently present. The parathyroid glands lie close to the posterior surface of the thyroid gland in the

tracheoesophageal groove in relationship with the recurrent laryngeal nerve, which is located posterior to the gland .However , many other possible locations of the parathyroid glands have been described viz. intrathyroideal , in the parapharyngeal space(undescended gland),in upper medistinum, retrotracheal , retroesophageal ,and intrathymic . Normal parathyroid glands are very thin and small, with the same echotexture as that of thyroid parenchyma.Thus; they are not detectable with USG.

Lymph nodes in the neck are arranged in seven main chains. The most clinically important and readily accessible to USG are the anterior jugular, the parotid, and the submandibular chains .The juxtavisceral, retropharyngeal, and spinal accessory chains are more easily detectable with CT or MR imaging. Normal lymph nodes are seldom visualized with USG because their echogenicity is similar to that of subcutaneous fat. Normal lymph nodes have an axial diameter between 2 to 5 mm. The jugulodigastic nodes are identified with USG in front of the jugular vein at the level of the mandibular angle and their size can be considered normal up to 1 cm in thickness and 2 cm in length.[1]

Neck Masses are any swellings or enlargements of the structures in the area between the inferior border of mandible and clavicle. The patient's age, the location, size and duration of mass are important pieces of information in the diagnosis of the neck masses.

In children most neck masses are benign. Almost 50% of all 2 yrs old children have palpable cervical lymph nodes. Although more than 25% of malignant tumors in children are found in the head and neck region, less than 2% of suspicious head and neck masses are malignant. Lymphadenopathy from viral or bacterial throat infection is the most common cause of neck masses in the children.[2]

The majority of neck masses in patients over forty years of age are malignant. The metastatic disease to the cervical lymph nodes is the most common type of cancer with 85% arising from an upper aero digestive tract primary, 10% from infraclavicular tumors and in 5% of the cases the primary is never discovered.[3]

There are myriad etiologies of neck masses but they can usually be divided into three broad categories.

1. Congenital 2. Inflammatory 3. Neoplastic

1. Congenital: - They are usually first noted in children but they can be present in adulthood. Branchial cleft cysts; hypoglossal cysts; cystic hygromas are the common examples.

2. Inflammatory: - These masses usually present with erythema, induration and tenderness. The most common inflammatory lesions in the neck are

lymphadenitis usually secondary to a pyogenic organism. Mycobacterium tuberculosis is a common cause of neck mass in our part of the world. Submandibular sialoadenitis, thyroiditis with thyromegaly are other important causes.

3. Neoplastic masses: - These may be benign lesions or malignant. Benign masses do not spread (metastasize) to surrounding tissue and are not cancerous. Nevertheless benign masses can be serious if they impact up on nerves or exert pressure in the neck. These include cysts, thyroid masses, vascular masses, salivary gland masses and few others. Malignant masses can be either primary or metastatic masses. Lymphoma is usually suspected in a patient who has similar nodes in other parts of the body. Primary tumors are usually characteristic based on their anatomical location such as thyroid or solitary tumors. However one must remember that malignancies may metastasize to organs such as the thyroid or parotid glands. Although the primary site for most tumors which metastasis to the cervical lymph nodes is the upper aero digestive tract, other tumors such as lung, breast, testicle and gastrointestinal tract also metastasize to this area.

Since there are so many potential causes of neck masses; it is important to proceed in logical and cost effective manner for the proper diagnosis of neck masses.

High resolution B- mode sonography has improved in the past few years and has become a very valuable tool in the diagnosis of the diseases of the head and neck. Sonography is commonly the first imaging modality after clinical examination. It is easily tolerated by the patients as it is without radiation and is inexpensive. It shows the origin of the lesion and differentiates whether it is cystic or solid. It provides information about the site of origin and infiltration into the soft tissue or vessels and mass effects. US guided FNAC is an added advantage. It provides valuable diagnostic information with a high degree of diagnostic accuracy and is useful in preparative evaluation of patients[8]. On the basis of sonographic finding, selection of additional imaging modalities including CT and MR imaging can be done more judiciously[4].

AIMS AND OBJECTIVEWS

1. To study the diagnostic accuracy of ultrasound in the diagnosis of neck masses, considering pathological diagnosis as gold standard.

2. To study the various sonographic finding of the neck masses.

HYPOTHESIS

"Ultrasonography has high degree of accuracy in diagnosis of neck masses."

MATERIALS AND METHODS

All patients with visible or palpable neck masses referred from indoor or outdoor services of BPKIHS were examined with detailed history, local and general physical examination. All the cases of neck masses with "clinical impression" were subjected to US examination.

The US examination was done with high-resolution small parts transducers on SIEMENS Verso p.r.o using 7.5 MHz linear probes. A systemic examination protocol was followed .The patients were examined in the supine position, with neck extended. A small pad was placed under shoulder to provide better exposure of the neck, particularly in the patient with short, stocky habitus .The procedure began with the examination of the thyroid gland where the instrument was adjusted and frequency and gain were optimized. The examination was continued along the vascular sheath to the floor of mouth, tongue, salivary glands, and tonsil and then to the status of lymph nodes including nuchal accessory followed by the evaluation of the transverse cervical esophagus. Color Doppler ultrasonography was used as and when required. The US finding was noted and ultrasonographic diagnosis was made. The patient was then subjected to FNAC and if FNAC was not conclusive then biopsy was done and reported by the pathologist. The cytopathological and/or histopathological examination reports of all patients were collected from the pathology department and were used as a gold standard for comparison with the US diagnosis.

After completion of the study the data collected were compiled and analyzed. Appropriate statistical tools were used to find out the important values.

Gooding GA et al[5] (1977) had done a study on 14 patients to illustrate the usefulness of USG in assessing masses of neck. They found it to be valuable for assessment of neck masses.

Chodosh PL et al[6](1980) demonstrated in their study that US is capable of differentiating not only cystic from solid lesions but can also be helpful in the diagnosis of malignant or benign masses. This study presents the value of US in delineating the presence of multiple lymph nodes as well as following the course of resolution of infectious diseases. Its use in the diagnosis of conditions involving the parotid gland as well as para pharyngeal space has also been discussed. US appears to be a valuable adjunct in management of head neck masses.

Baker SR et al[7] (1981) had done ultrasonic analysis of head and neck neoplasms and their results showed that USG of head and neck neoplasm is useful in the preoperative evaluation of patients.

Anita p. Friedman, Jack o. Haller et al[8] (1983) reviewed the sonographic finding of 17 children with non inflammatory neck masses. The sonographic appearance of 17 neck masses were divided into three categories; cystic, solid (hypoechoic or hyperechoic) and complex. There were 6 cystic lesions, seen as sharply defined areas free of internal echoes but with strong far-wall echoes and variable sound transmission. Four masses were solid and uniform in appearance, whether hypoechoic or hyperechoic.All had internal echoes. The 7 complex masses were essentially cystic but contained persistent internal echoes. In this study they found that USG has both strengths and weaknesses as an imaging modality. On the positive side, USG can show whether a mass is cystic, solid, or complex. Finally and perhaps of greatest importance is he fact that USG can illustrate normal anatomy, identify vascular structure and determine their relation to the mass and provide information regarding the size, location and extent of the mass. On the negative side in this study they were unable to make sonographic criteria for differentiation of benign from malignant thyroid lesion.

Subramanyan BR et al[9] (1984)reviewed patients with pulsatile neck masses and found that real - time sonography provides a noninvasive and accurate method to diagnose buckling of great vessels of neck and as the cause of pulsatile neck masses.

Sherman NH. et al[10] (1985): evaluated 34 children with neck masses, Twenty-two patients had lesions arising outside the thyroid gland and 12 lesions arose from the thyroid gland. Ultrasonography proved to be an accurate imaging modality for localizing the mass and demonstrating its relationship to the thyroid gland, trachea and major neck vessels. Based on this the authors recommend that ultrasonography be the first screening procedure.

Richard Kraus, Bokyung K. Han et al[11] (1985) reviewed sonogram of 49 patients referred for neck masses between 1978 and 1985.The patients ranged in age from 3 weeks to 18 years. The sonogram was performed with sector real-time 7.5 MHZ transducer. The masses were divided into inflammatory and noninflammatory. The noninflammatory masses were further subdivided into benign and malignant. The thyroid masses were categorized separately. The summaries of the cases were as follows.

Type of masses	No. of cases
Inflammatory masses(non thyroid)	12
Non inflammatory masses	
Benign	
Thyroglossal duct cyst	6
Sternocleidomastoid mass	4
Cystic hygroma	5
Hemangioma	4
Malignant	
Neuroblastoma	1
Teratoma	1
Leukemia/Lymphoma	2
Thyroid masses	
Thyroid masses	3
Hashimoto thyroiditis	5
Cyst	3
Adenoma	2
Ectopic thyroid	1
TOTAL	49

12 cases of inflammatory masses (nonthyroid) were clinically diagnosed as lymphadenitis and/or abscess. The sonographic characteristic of inflammatory masses varied, being either inhomogeneously echogenic or of mixed echogenicity. Noninflammatory masses, both benign and malignant, had characteristic sonographic appearance. Thyroid masses also had a variable sonographic appearance. They found in their study that sonography is useful imaging method in the evaluation of neck masses in children. Although some entities most notably inflammatory masses, have a variable appearance, certain masses have characteristic appearance, and accurate sonographic diagnosis can be made.

D. Gianfelice, S. Jequier et al [12](1986) examined 111 patients with neck masses aged two days to 2 year by USG. All patients were examined with real time sector scanners (7.5 MHz).The group consisted of 65 males and 46 females .Only patients with subsequent pathological and/or clinical proof of the diagnosis were included in the study. Of these patients 88 had histo-pathological proof of the diagnosis. In 23 children the diagnosis was made clinically: in 15 adenopathy disappear with medical treatment, 5 hematoma of the sternocleidomastoid

muscle resolved under observation and 3 aberrant thyroid glands had proof of diagnosis by ^{131} isotope scan.Sonographically, there were two groups of patients: one with sonospecific masses where the initial ultrasound leads to relatively accurate presurgical diagnosis and a second group with indeterminate masses. Sonospecific neck masses contain a total of 48 patients, consisting 31 thyroid masses, 7 cystic hygromas, a cervical myelomeningocele and 9 cases of adenopathy. In this patient population, sonography alone was diagnostic preoperatively in 44 out of the 48 cases. Sonographically non specific neck masses consisted of 63 patients. In their study, 30 patients were of single lymphadenopathy, 11 presented with a single hypoechoic mass (9 inflammatory, 2 malignant). In the remaining 19 patients there was a single well defined mass of varying echogenicity.In 4 of these 19 patients there was a hypoechoic centre in the mass proven pathologically to be central necrosis in an inflammatory node. In 8 patients with hemangioma –lymphangioma, sonographic evaluation revealed a spectrum of septated mixed echogenic masses with hypoechoic area. Some masses contained more cystic components while others appeared to have echogenic with hypoechoic areas. The neck masses of the remaining 25 patients in this group included two dermoid cysts,6 branchial cleft cysts,7neoplastic masses(two rhabdomyosarcomas,two lymph sarcomas, one dermoid tumor ,one schwannoma and one teratoma)5 patients with hematomas of the sternocleidomastoid muscle , one patients with a hypertrophied masseter muscle ,two parotid masses (one hemangioma,one mucoepidermoid),one mucocele and one superficial neck abscess. In these 25 patients a single mass of varying echogenicity and homogeneity was the only sono graphic finding. Sonographic pathological correlation in their series of 111 patients allowed them to evaluate the specific strengths and limitations of neck masses. Sonography of thyroid gland proves to be an accurate presurgical tool. Certain cases of adenopathy can be accurately diagnosed presurgically by sonography. Cystic hygroma were also accurately diagnosed by sonography.In this study they found that in cases with non specific group of neck masses , USG is not accurately diagnostic but helpful in delineating the extent of the mass and its relationship to the thyroid gland and major vessels of the neck.

Sheila sheath, Anna R. et al [13](1987) reviewed 16 children with cystic hygroma between January 1981 and March 1986. A review of their medical charts revealed that eight patients had undergone USG examination. The sonographic findings in 8 children with surgically proved cystic hygroma were reviewed and correlated with pathological specimens. In this study the cystic hygroma characteristically appeared as a multiloculated cystic mass with septa of variable thickness that contained solid component arising from the cyst wall or the septa. Correlation of the sonogram with the pathological specimen demonstrated that the echogenic component corresponded to the cluster of abnormal lymphatic channels too small to be resolved with USG. Large lesions had ill-defined boundaries, with cystic components dissecting between normal tissue planes. The study showed that sonography is helpful in determining the extent of lesion before surgery and in assessing postoperative complications and recurrences.

Gonczij et al [14](1988) analyzed 70 cases of palpable neck masses on the basis of histological diagnosis. The cases were put into groups of cysts, tumors and other lesions of neck. According to this grouping the etiological factors were also discussed. The diagnostic value of ultrasonography was calculated in view of the morphologic signs of a given lesion. The specificity, sensitivity and accuracy of ultrasound in this study supports the view that in the differential diagnosis of neck masses US is useful, simple and effective tool.

Lorenzo E. Derchi et al [14](1992) reviewed the USG findings in 20 patients with 23 carotid body tumor who were examined from January 1984 to March 1991. The USG depicted 22 of the23 carotid body tumor. The lesions ranged from1.2 to 5 cm in maximum diameter .They had regular margins and were solid and often hypoechoic and heterogeneous. Small vascular channels were often visible in them. The lesions were contained within the carotid bifurcation. In this study, on the basis of the USG findings 18 of the 20 patients were diagnosed.

Bergami et al[16] (1995) studied 55 patients, whose age ranged from 14 to 153 days. Those patients with clinical suspicion of sternocleidomastiod mass were examined with US. US was confirmed as a valuable tool to diagnose and follow up of sternocleidomastoid masses.

R.A.K.Set, K. Oleszczuk et al [17](1996) assessed 57 sonograms of 18 children with Hashimoto thyroiditis. 33 examinations showed thyroid glands which were more reflective than adjacent strap muscles, 22 studies demonstrated glands which were equally reflective and two examinations depicted thyroid gland of lower reflectivity than muscle. The most frequent USG appearance consisted of 2-5mm echopenic lesions generally distributed throughout large poorly-defined hyperreflective glands. The study showed that the sonographic findings in children with Hashimoto thyroiditis are variable and the most frequently observed pattern in study is wide coarse echopenic areas within an enlarged thyroid which maintains its reflectivity. This study showed that USG was helpful in the diagnosis of Hashimoto thyroiditis.

A. Ahuja, M. Ying[18] et al (1996) reviewed the USG of 68 patients with cervical lymphadenopathy. Spectrum of USG findings were noted to differentiate NHL from other metastasis. These were distribution of nodes, distal enhancement, and lack of intranodal necrosis.The study showed that these findings were highly specific and sensitive in differentiating cervical lymphomatous lymph nodes from cervical metastatic lymph nodes.

A. Ahuja, M. ying et al[19] (1996) reviewed the USG scans of 140 patients (702 nodes) with cervical Lymphadenopathy. Spectrum of diseases evaluated in this study was as follows:

	Number of patients
Pharynx , larynx esophageal carcinomas	13
Oral cavity carcinoma	12
Infraclavicular carcinoma	10
Papillary carcinoma of thyroid	30
Nasopharyngeal carcinoma	30
Non-Hodgkin's lymphoma	15
Tuberculous lymphadenitis	30
Total	140

There were 65 males and 75 females with an age range of 13-94 years. These appearances were compared to nodal appearances previously described in similar sites in 100 normal Chinese subject (ying et al1996). In all the patients, cytological and or histological diagnosis was obtained from the largest node. In each patient, all nodes with USG appearance similar to the aspirated or biopsied node were then considered to have a similar pathology. All the scans were performed on a commercially available scanner with a linear 7.5 and sector 10 Mhz transducer. In evaluating the nodes the features they looked at were distribution, the size and the shape of the nodes, echogenic hilus, echogenicity, calcification, intranodal necrosis, nodal border, posterior enhancement, and ancillary features such as soft tissue edema and matting of nodes. In evaluating size, for the definition of metastatic nodes of ENT cancer, 8 mm was taken as cutoff point. For nodes less than 8 mm all nodes with intranodal necrosis were considered malignant. Shape was assessed on the basis of short axis (SA) to long axis (LA) ratio .SA/LA ratio greater than 0.5 indicates round nodes and less than 0.5 indicates oval nodes. In assessing internal architecture they looked at cystic necrosis, coagulation necrosis, and presence or absence of hilus.The soft tissue were analysed for oedema of the subcutaneous tissue and/or adjacent muscle. Matting was defined as clumped up nodes adherent to each other. In the study, the help of various USG features as described above were found to be useful in distinguishing between various pathology of lymphadenopathy.

A.T. Ahuja, A. D. King et al [20](1997) reviewed 25 patients with soft tissue masses in the neck by USG as the initial imaging modality. Lipomas were suspected on the basis of findings at clinical examination in 8 of these patients .Lipomas were conformed by fine-needle aspiration cytology in 11 patients ,by excision biopsy in five patients, by CT in two patients and by clinical examination with clinical sonographic follow up (6 month to 2 years)in seven cases. In the study, lipomas were well-defined (88%), compressible (100%), elliptical masses with the longest diameter parallel to skin surface. All contained multiple echogenic lines parallel to the skin surface with no evidence of posterior enhancement or attenuation and no flow on color Doppler sonography compared with adjacent muscle. 76% of all lipomas were hyperechoic, 8% isoechoic and 16% hypoechoic.

Baatenburg de Jong RJ et al[21] (1998) evaluated the contribution of USG to the diagnosis and assessment of cervical tuberculosis adenities (CTA). It has been concluded that, since the other diagnostic tests for CTA are not reliable and / or time - consuming, the demonstration of nodal calcifications, conglomerate nodal masses and spread into the subcutaneous tissues by US in patients with elusive cervical masses may result in earlier recogning of CTA.

A.T.Ahuja, A. A. D. King et al [22] (2000) reviewed 23 children with Thyroglossal cysts. All USG were performed by the same sonologist .These were reviewed by two radiologists with 8 and 3 years experience in head and neck sonography.There were 11 girls and 12 boys(2-15 year). USG examinations were performed with 7.5 or 10 MHz linear array transducer and images were obtained in transverse and longitudinal planes. The sonograms were evaluated for the following features: Site of mass, size, walls, margins, loculation, internal echogenicity, posterior enhancement, internal septa, solid component,the presence or absence of the thyroid tissue.Of the 23 lesions,19(82.6%) were located in midline,4(17.4%) were off mid line,11(47.8%)were infrahyoid ,11(47.5%)at the level of hyoid and 1(4.4)was suprahyoid. 19(82.6%)had thin wall and 4(17.4) were thick walled. 3(13%) were anechoic ,13(56.5%)were hyperechoic , 7(30.5%)showed heterogeneous features. Only 13(56.5%) showed posterior enhancement. This study showed USG appearance of thyroglossal cysts which are not simple cysts but have complex pattern ranging from a typical anechoic to a pseudosolid appearance.

Sajeeba S et al[23](2000)studied the use of ultrasound in evaluating metastatic neck masses in 25 patients. They found that it is useful not only in detection of neck masses, but also in assessing their characteristics and the degree of vascular invasion. They recommended that US be routinely performed as part of evaluation of all patients with head and neck masses.

Pankaj gupta, John maddalozzo et al[24] (2001) reviewed a retrospective study of 45 patients with mid line neck masses, 39 of whom had undergone preoperative USG as their sole diagnostic imaging study. In all 39 patients, both a cyst and a normal thyroid gland were identified. All 39 patients had undergone the standard sistrunk procedure. 37 patients had pathologically conformed thyroglossal duct cysts. The remaining 2 had dermoid cysts. This study proved that USG is an accurate, cost-effective, non-invasive imaging modality in preoperative evaluation of all patients with neck masses suspicious for thyro-glossal duct cyst.

John A. McCurdy, Jr. MC et al[25] (2001) reviewed 40 cases of extra thyroid masses of head and neck and correlated USG findings with clinical and histological findings. All masses were characterized sonographically as cystic, solid or complex. Their findings in 40 extra thyroid masses were as follows:

Diagnosis	No. of cases	Appearance on USG Examination
1.Inflammation		
Abscess	7	5 cystic , 2complex
Adenopathy	5	solid with few internal echoes
2. Benign neoplasm		
Hemangioma	5	2 solid , 2 cystic ,1 complex
Parathyroid adenoma	2	solid
Epidermal inclusion Cyst	3	2 mixed cystic with echoes , 1cystic
Lymphangioma	1	complex
Plexiform Neurofibroma	1	solid
chemodectoma	1	solid
ectopic thyroid rest	1	cystic
others	4	3 solid , 1 cystic
3.Malignant	10	solid

They found USG to be valuable in differentiating cystic from noncystic masses, in determining the nature of inflammatory masses and in many cases it allows determination of margins of a mass and its relationship to adjacent structures.

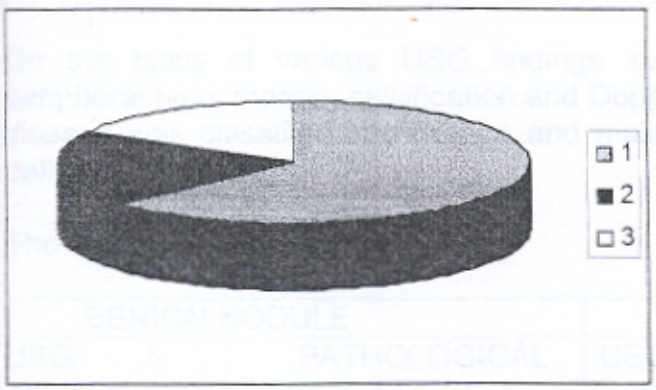
In another study of sonography of soft tissue masses of the neck, Gritzmann N., Hollerweger Alois et al[4(1985)] found that cervical cysts, lipoma, paraganglioma, neurogenic tumours, hemangioma, and lymphangioma often exhibit characteristic sonographic appearance. Sonography can be used for lymph node assessment, and most salivary gland diseases can be diagnosed sonographically.They found that most cervical cysts arise from the thyroid gland and they usually represent the end stage of degenerative thyroid adenoma. Other common cervical cysts are thyroglossal cysts and branchial cleft cysts. Cystic hygroma, laryngoceles are found less frequently. Soft tissue neoplasm they found are Lipoma, paraganglioma, neurogenic tumors, hemangiomas and lymphangiomas. Sonographically these lesions shows characteristic appearance. Sonographic appearance of various causes of enlarged lymph nodes were also described. Common causes being reactive adenitis, viral or bacterial lymphadenitis and tubercular lymphadenitis. In this study, the sensitivity of sonography in the diagnosis of cervical lymph node metastasis was more than 90% with specificity of 85 to 90%.They were unable to differentiate Hodgkin's and nonhodgkin's lymphomas, however characteristic sonographic appearance of lymphoma was noted. Because of the superficial position of major salivary glands, the parotid, submandibular, and sublingulal gland were assessed sonographically. They also showed characteristic sonographic appearance.

Anurag Jain, Sumedha Pawa et al [26](2002) evaluated total of 94 patients with clinically suspected thyroid disease by high resolution sonography. There were 20 patients with malignant thyroid lesions . Using sonographic appearance thyroid abnormality was classified as diffuse or focal. Focal abnormality was further classified as solitary or multinodular. The echo pattern was graded as hypo ,iso ,hetero and anechoic .The presence of halo was looked for and evaluated for width , regularity and completeness. Calcification if present was classified as coarse , micro and rim calcification. Lesion and gland outline was evaluated for regularity. An attempt was made to evaluate retrotracheal and retrosternal extension of thyroid. Extrathyroidal involvement in the form of lymphnode ,muscle /tracheal infiltration and involvement of carotid and internal jujular vein were specifically looked for. Vascularity in lesion was evaluated using color Doppler flow imaging. The study showed that papillary carcinoma was the commonest thyroid malignancy .The majority (56 %) of these lesions had mixed consistency. Predominantly solid lesions were seen in 22% and equal number showed predominantly cystic lesion .A variable echo pattern was found with only one patient showing hyperechoic lesion. Diffuse involvement was seen in 2 patients and 5 patients showed multinodularity at sonography. Halo was observed in 1 patient and was thick, irregular and discontinuous. Calcification was seen in four patients of which coarse calcification was seen in 3(33%) patients and microcalcification in 1 patient. The sonographic calcific nodule in cyst was seen only in 1 patient. Significant cervical adenopathy was seen in 5 (86%) patients, muscle infiltration in (22%) patients, and tracheal infiltration in 1 patient. CDFI done in 5 patients revealed intralesional vascularity. Medullary carcinoma was present in 4 cases. All 4 showed solid hypoechoic nodular thyroid lesions. Multinodularity was seen in 3 patients and 1 patient had a solitary thyroid nodule. Microcalcification was seen in one patient. Metastatic cervical adenopathy was seen in 3 patients and tracheal infiltration in 1 patient. Three cases of follicular carcinoma were present in the study – solid, predominantly hypoechoic lesion were seen in 2 patients and 1 patient showed mixed consistency. Multinodularity was seen in 2 patients.The dominant, solitary thyroid mass lesion in all 3 cases exhibited ill defined internal nodularity. Coarse calcification was seen in 2 cases and rim calcification was in one patient.2 cases of anaplastic carcinoma were seen, one as solitary thyroid nodule and other as diffuse involvement of thyroid. Both cases had predominantly hypoechoic lesions. Coarse calcification was seen in 1 patient.There were 2 cases of metastatic lesions. One case presented as a solid hypoechoic illmarginated avascular mass. The other case showed multiple , heteroechoic , well defined nodular lesions in thyroid with areas of cystic adegeneration and coarse calcification . Both the nodules were avascular on CDIF. This study showed that sonography is useful in identifying the malignant lesions of thyroid .

OBSERVATION AND RESULT

During the ten month period from July 2003 to April 2004, 100 patients (70 female and 30 male) of neck swelling (age ranged from 2 month to 76 years) with "clinical impression" referred to the department of radio-diagnosis, BPKIHS were subjected to USG scanning of neck.

On the basis of the anatomical site of origin, the neck masses were classified into three main groups - thyroid masses, lymph nodal masses and other neck masses.



1: thyroid masses

2: lymph nodal masses

3: other neck masses

On the basis of various USG findings, USG diagnosis of the neck masses was given which were conformed by cytopathological/ histopathological examination.

The total number of cases in each category was as follows:

Neck masses	Male	Female	Total
1.Thyroid masses	8	55	63
2.Lymph nodal masses	11	9	20
3.Other neck masses	11	6	17

Thyroid masses were classified as nodular thyroid diseases and diffuse thyroid diseases. The nodular thyroid diseases were again classified as solitary or multinodular.

The total no. of cases in thyroid masses was as follows:

	Female	Male	Total
Nodular thyroid Disease	47 (88%)	6 (12%)	53
a. Solitary	20 (86%)	3 (14%)	23
b.multinodular	27 (90%)	3 (10%)	30
Diffuse thyroid disease	8 (80%)	2 (20%)	10

On the basis of various USG findings like internal contents, echogenicity, peripheral halo, margin, calcification and Doppler flow pattern, the nodular thyroid disease was classified into benign and malignant nodules and compared with pathological findings.

The result was as follows:

BENIGN NODULE		MALIGNANT NODULE	
USG	PATHOLOGICAL	USG	PATHOLOGICAL
42	41	11	12

This gives USG 100% sensitivity and 91% specificity in differentiating benign and malignant thyroid nodules.

The sonographic features in the differentiation of benign from malignant thyroid nodules were as follows:

	BENIGN NODULES	MALIGNANT NODULES
Solitary	22 (52%)	6 (54%)
Multiple	20 (47%)	5 (45%)
Internal contents		
a. Purely cystic	2 (4%)	-
b. Cystic with thin septa	1 (2%)	-
c. Mixed solid &cystic	29 (69%)	2 (18%)
d. Solid	10 (23%)	9 (81%)
Echogenicity		
a.hyperechoic	12 (28%)	1 (9%)
b.isoechoic	20 (47%)	2 (18%)
c.hypoechoic	10 (23%)	8 (72%)
Halo		
a. thin halo	42 (100%)	1 (9%)
b.thick incomplete halo	------	10 (90%)
Margin		
a.well defined	40 (95%)	1 (9%)
b.poorly defined	2 (4%)	10 (90%)
Calcification		
a.eggshell	1 (2%)	-------
b.coarse	20 (47%)	1 (9%)
c.micro	------	3 (27%)
d.no calcification	20 (47%)	8 (72%)
Doppler		
a. peripheral flow	42 (100%)	4 (36%)
b.internal flow	-----	7 (63%)
Enlarged cervical LN	--------	3 (27%)

In the study, one case in which there was evidence of multiple hypoechoic areas with well defined margin and thin regular halo was given USG diagnosis of multinodular goiter, which on histopathological examination came out to be papillary carcinoma of thyroid.

In the benign cause all were nodular colloid goiter (either solitary or multinodular). In the malignant causes 6 were papillary and 5 were follicular carcinoma. Anaplastic and medullary carcinomas were not found in the study.

In this study there were 10 cases of diffuse thyroid enlargement. The criteria taken for diffuse thyroid enlargement were anteroposterior dimension of more than 10mm.

USG diagnoses of the diffuse thyroid disease were given on the basis of various sonographic features like echogenicity, vascularity, multiple discrete hypoechoic micro nodules. USG diagnoses were conformed by pathological diagnosis. The result was as follows:

Thyroiditis (Hashimoto's thyroiditis & de Quervain's thyroiditis)		Adenomatous goiter	
USG	PATHOLOGICAL	USG	PATHOLOGICAL
8	7	2	3

This gives USG 100% sensitivity and 66% specificity in diagnosing various causes of diffuse enlargement of thyroid gland.

One USG diagnosis of Hashimoto's thyroiditis came out to be adenomatous goiter on pathological examination.

Various causes of diffuse thyroid enlargement were as follows:

Hashimoto's thyroiditis	4
de Quervain's disease	4
Adenomatous goiter	2

Sonographic findings in each group was as follows:

	Hashimoto's	de Quervain	Adenomatous
Echogenicity			
coarse	3 (75%)	----	
hyperechoic	-----	----	
isoechoic	----	----	2 (100%)
hypoechoic	4 (100%)	4 (100%)	
Vascularity			
normal	---	2 (50%)	2 (100%)
decreased	----	2 (50%)	
increased	4 (100%)	-----	
Multiple discrete hypoechoic micro nodules	4 (100%)	----------	1 (50%)

In the study, 20 cases of neck swelling were lymph nodal masses. In the evaluation of these nodal masses sonographic features taken into consideration were distribution, the size and shape, echogenic hilus, echogenicity, calcification, intranodal necrosis, nodal border, posterior enhancement, soft tissue edema and

matting of the nodes. With the help of these sonographic findings, USG diagnoses of malignant or benign causes were given and these were conformed pathologically.

The no. of cases and their USG and pathological diagnosis were as follows:

	MALIGNANT		BENIGN		
	Lymphoma	metastasis	TB	RA	NSLA
USG	3	8	6	2	1
PATHOLOGICAL	2	7	7	3	1

NOTE: TB-tubercular lymphadenitis, RA: reactive lymphadenitis, NSLA: nonspecific lymphadenitis.

With above findings the USG diagnosis was 100% sensitive and 81% specific.

One case of USG diagnosis of lymphoma turned out to be tubercular adenitis and one case of USG diagnosis of metastasis turned out to be reactive adenitis.

The sonographic features in various causes of lymph nodal masses were as follows:

	Metastasis	Lymphoma	TB adenitis	Reactive adenitis	Nonspecific adenitis
1.Shape					
RI < 1.5	7 (87%)	3 (100%)	2 (33%)	1 (50%)	----
RI > 2	1 (13%)	-----	4 (66%)	1 (50%)	1 (100%)
2.Echogenicity					
anechoic	-----	2 (66%)	1(17%)	---	----
hypoechoic	8 (100%)	1 (33%)	5 (83%)	2 (100%)	1 (100%)
isoechoic	----	---	---	---	----
hyperechoic	----	---	---	---	----
homogenous	----	3 (100%)	1 (17%)	1 (50%)	1 (100%)
heterogeneous	8 (100%)	-----	5 (83%)	1 (50%)	-----
3.Hilus absent	8 (100%)	3 (100%)	6 (100%)	1 (50%)	1 (100%)
4.Calcification	3 (37%)	-----	4 (66%)	----	-----
5.Cystic necrosis	5 (62%)	----	3 (50%)	-----	-----
6.Nodal border					
sharp	7 (87%)	3 (100%)	----	2 (100%)	1 (100%)
unsharp	1 (13%)	----	6 (100%)	----	----
7. Posterior enhancement	-------	3 (100%)	1 (16%)	-----	-----
8.Invasion / encasement	2 (25%)	----	1 (16%)	----	----
9.Matted	----	----	6 (100%)	-----	-----

NOTE: RI (roundness index) is ratio between the longitudinal and transverse diameter.

On the basis of various sonographic findings and their anatomical locations USG diagnosis of neck masses other than thyroid and enlarged lymph node were made which were conformed by histopathological / cytopathological examination.

The number of cases and their USG diagnoses were as follows:

Lipomas	5
Thyroglossal cyst	4
Cystic hygroma	3
Hemangioma	2
Pleomorphic adenoma	2
Carotid body tumor	1
Total	17

USG diagnosis of 5 cases in the study was lipoma. The sonographic findings considered for diagnosis were shape, echogenicity, presence of echogenic parallel lines, border, compressibility, posterior enhancement, and color flow pattern.

The sonographic findings were as follows:

1Shape	
elliptical	5 (100%)
2.Border	
well defined	3 (60%)
ill defined	2 (40%)
3.Compressibility	4 (80%)
4.Echogenicity	
hyperechoic	5 (100%)
5.multiple echogenic lines parallel to skin surface	5 (100%)
6.posterior enhancement	------
7.color flow pattern	
no flow	5 (100%)

In the study 4 cases were sonographically diagnosed as thyroglossal cyst. The sonographic findings that were considered for diagnosis were site, wall, margin, internal architecture, posterior enhancement.

The sonographic findings were as follows:

1. Site	
midline	4 (100%)
suprahyoid	3 (75%)
infrahyoid	1 (25%)
2.Wall	
thin	2 (50%)
thick	2 (50%)
3.internal architecture	
anechoic	3 (75%)
hypoechoic	1 (25%)
isoechoic	----
hyperechoic	-----
homogenous	3 (75%)
heterogeneous with mural nodule	1 (25%)
4.Margins	
regular	2 (50%)
irregular	2 (50%)
5.posterior enhancement	2 (50%)

USG diagnosis of three cases in the study was cystic hygroma. The sonographic finding which was considered for diagnosis was multiloculated cystic areas. In the study two cases were multiloculated cystic masses with variable septa and one was anechoic with thin septa.

In the study, in two cases of neck masses, USG showed hypoechoic, homogenous sharply marinated area in parotid gland and was given the diagnosis of Pleomorphic adenoma. One case also showed cystic changes.

In the study two neck swellings were given the diagnosis of Hemangioma. Both had several, small anechoic area with echogenic linear septation and calcification.

One case of neck swelling in the study had undergone FNAC before USG, since on physical examination the swelling was thought to be an enlarged lymphnode. On USG there was heterogeneous solid mass at carotid bifurcation with increased vascularity.The USG diagnosis was carotid body tumor.

In view of the above findings, there were variable sonographic findings of these neck masses.

DISCUSSION

Neck swelling is a very common clinical condition. For the proper management of this condition, proper assessment of the neck swelling is very important. Palpation is the only clinically relevant method of examination and it is insensitive.[26] In the modern era USG has proved useful in imaging neck masses[27] Isolated case reports of USG featuring various neck masses have also appeared in the literature along with study regarding the usefulness of USG in diagnosis of neck masses. In the present study the sonographic appearance of various neck masses are analysed and compared with previous reports.

Sonography of the neck in the past has proven to be an excellent tool to evaluate thyroid pathology.[28] In one study Rojeski M T et al [29] found women being more frequently affected by nodular thyroid disease. In the present study also 88% were female.

Henneman et al [30] found in their study that 80% of nodular thyroid diseases were benign. Holtzs et a[31] and another study by Solbiati et al[32] reported that no single sonographic criterion distinguishes benign thyroid nodules from malignant nodules with complete reliability. The fundamental anatomical features of thyroid nodule on high resolution sonography are

-internal consistency (solid, mixed solid and cystic, or purely cystic)
-echogenicity
-margin
-presence and pattern of calcification
-peripheral sonolucent halo
-presence and distribution of blood flow signals.[33]

The study by Luigi solbiati et al[32] showed 70% of benign thyroid nodules to be solid while 30% exhibited various amount of cystic component. Cystic component was usually present in benign lesions. Another study by Anurag Jain et al [23] showed that majorities (56%) of malignant lesions were of mixed consistency and 22% of papillary carcinoma had cystic changes. Various authors have documented the manifestation of papillary carcinoma in the form of predominantly cystic lesions. First such case was reported by Allen et al in 1979. Other authors reporting such an appearance include Simeone et al in 1982, Hatabu et al in 1991, Barki et al in 1992 and LuC et al in 1994. Hammer et al[34] reported varying amount of cystic changes in papillary carcinoma indistinguishable from benign cystic nodule. In present study majority of benign nodule are mixed (solid and cystic) i.e. 69% followed by solid only (23%), purely cystic (4%) and the less common was cystic with thin septa (2%). Present study shows that 81% of malignant nodules are solid and 18% are mixed. No case of purely cystic nodule proved to be malignant.1 out of 6 (16%) papillary carcinomas in the study shows cystic changes.

Variable echo pattern were reported in the literature for both malignant and benign thyroid nodules. Anurag Jain et al [26] found in a study that out of 20 patients of malignant thyroid nodules, 19 were hypoechoic and 1 was hyperechoic (papillary carcinoma).Luigi solbiati et al[32]also described the most common pattern for malignant nodules being hypoechoic. In the present study 72% of malignant nodules are hypoechoic, 18% isoechoic and 9% hyperechoic. Histologically this hyperechoic nodule is papillary carcinoma. Hyperechoic papillary carcinomas although uncommon, have been reported in the literature (LuC et al 1994, solbiati et al 1992). In the present study benign nodules are isoechoic (47%), hyperechoic (28%) and less commonly 23% being hypoechoic.

Solbiati L. Volterrani et al [35] reported that a peripheral sonolucent halo that completely or incompletely surrounds a thyroid nodule may be present in 60 to 80% of benign nodules and 15% of malignant nodules. In the present study thin halo is present in all cases (i.e.100%) of benign nodules and thick incomplete halo in 90% of malignant nodules.

Luigi solbiati et al[32] reported that sharp, well defined margins are common in benign nodules as compared to irregular or poorly defined margins in malignant nodule. Present study shows that 95% of benign nodules are with well defined margins and 90%of malignant nodules have poorly defined margins.

Solbiati L. Volterrani et al[35]reported 10 to 15 % of calcification in thyroid nodule but pattern of calcification have more predicative value in distinguishing benign from malignant lesions. In the present study 53% of benign nodules and 28%of malignant nodules demonstrate calcification. Luigi solbiati et al [32] reported peripheral and eggshell calcification to be more common and reliable features of benign nodules and microcalcification for malignant nodules. The high specificity of microcalcification in diagnosis of malignant (papillary and medullary) is well documented in literature(Gormen et al 1987, Solbiati et al 1991, Takashima et al1995).Based on various sonographic features microcalcification shows the highest accuracy (76%), specificity (93%),and positive predicative value(70%) for malignancy as a single sign. however sensitivity is low (36%).In the present study 27% of malignant nodules show microcalcification and 9% show coarse calcification.47% of benign nodules show coarse calcification,2% show eggshell calcification .

Anurag Jain et al[26] reported intralesional vascularity in all thyroid malignancies. Various study done by Lagalla R et al[36]in 1992,Solbiati L. et al[35] 1995, Argali G. spiezia S. Colaa et al[37] demonstrated that 80 to 95 % of benign nodules display peripheral vascularity while 70 to 90 % malignant nodules display internal vascularity with or without peripheral component. In the present study, 100% of benign nodules show peripheral flow. 63% of malignant nodules show internal flow and 36% shows peripheral flow.

Anurag Jain et al[26] reported that 86% of papillary carcinoma have cervical lymphadenopathy. In the present study 27% of malignant nodules (all papillary carcinoma) show enlarged lymphnode.

Overall in the present study regarding the nodular thyroid disease majority (79%) are benign nodules. Benign nodules are predominantly solitary (52%), mixed (69%), isoechoic (47%), well marginated (95%) with thin peripheral halo (100%) and coarse calcification (47%). On color Doppler they show peripheral flow pattern.

Malignant nodules are predominantly solitary (54%), solid (81%), and hypoechoic (73%) poorly marginated(90%),with thick incomplete halo(90%) and microcalcification(27%). On color Doppler they show internal flow (63%). Cervical lymphnode metastasis is found in 27% cases.

Several thyroid diseases are characterized by diffuse rather than focal involvement. Specific conditions that commonly produce such diffuse enlargement include chronic autoimmune lymphocytic (Hashimoto's) thyroiditis, subacute granulomatous thyroiditis (de Quervain's thyroiditis), colloid or adenomatous goiter and Grave's disease. In present study there are no cases of Grave's disease.

The most common type of thyroiditis is chronic autoimmune lymphocytic (Hashimoto's) thyroiditis.Poyhonen and Lenko et al[38] reported gland enlargement with" patchy echopoorness"as the main finding. Bachrach et al[39] found that 47% of the children with Hashimoto's thyroiditis had abnormalities which consists of nonhomogenous echopatterns without definite nodules. They reported that these features were indistinguishable from those found in children with iodine deficiency goiter.P.A.K set et al[40]in 1995 reported that the most frequent intraglandular abnormality consisted of coarse echopenic foci(57 to 76%),fine lesions being the least common. Yeh HC et al[41]reported sonographic appearance of Hashmoto's thyroiditis is diffuse glandular enlargement with homogenous but coarse parenchymal echotexture, generally more hypoechoic than normal thyroid gland. In the present study coarse echotexture was found in 75%and 100% are hypoechoic. Vascularity is increased in 100% of the cases. Multiple discrete micronodules were noted in 100% of the cases. One case of diffuse parenchymal inhomogenicity and micronodularity came out to be adenomatous goiter. Literature has also described that it is difficult to differentiate between these two conditions. Bachrach et al[42] reported that sonographic finding of Hashimoto's thyroiditis were indistinguishable from adenomatous goiter. L. solbiati et al[33] have also described that adenomatous goiter have similar appearance as Hashimoto's thyroiditis.

Sub acute granulomatous thyroiditis is a spontaneously remitting inflammatory disease that is probably caused by viral infection. Brander A et al[43] in1989,

Adams H. Jones et al[44] in 1990 and Birchall et al[45] in 1990 reported that sonographic appearance in this condition were enlarged gland with hypoechoic echotexture and decrease or normal vascularity.In the present study 100% cases are hypoechoic and diffusely enlarged. 50% had normal vascularity and 50% had decreased vascularity.

Adenomatous goiter is also important cause of diffuse thyroid disease. As described above sonographic features are very similar to Hashimoto's thyroiditis. L. solbiati et al[33]described the sonographic features as diffuse enlargement of the gland with multiple discrete nodules separated by normal parenchyma. In the present study there is diffuse enlargement of the gland with isoechoic echotexture in 100% cases. Normal flow is noted in 50% cases and decreased flow in 50% cases.

In overall when thyroid gland is diffusely involved and enlarged, then its echotexture, vascularity and presence or absence of hypoechoic micronodule is very important to differentiate various pathologies.

The majority of the normal lymphnode in the neck show an axial diameter of 2 to 5 mm with exception of jugulodigastric and jugulo- omohyoid lymph nodes, which are larger and reveal an axial diameter of 8 to 10 mm and a longitudinal diameter of 15 to 20mm.Normal lymphnode are difficult to detect because of their high echogenicity , which is similar to the surrounding fatty tissue.[4] Disease of the lymph nodes lead to an increase of fluid either by swelling of the histocytes in the sinus, by hyperplasia of lymph follicles or by invasion of tumor cell. As a consequence, this results nearly always in enlargement of the lymph nodes and a reduction in echogenicity.[46]

In evaluating the nodes the features looked at were size, shape, echogenic hilus, echogenicity, calcification, intranodal necrosis, nodal border, posterior enhancement, soft tissue edema and matted lymphnode.

The shape of the lymph node was assessed on the basis of roundness index (RI). It is the short to long axes ratio.[47] Solbiatic L. et al[47] reported that RI has a higher degree of accuracy in differentiation between inflammatory and malignant lymph nodes. Their study showed that RI>2 indicate inflammatory disease in 84% where as RI less than 1.5 favors metastatic involvement in 71% cases. In the present study 87% of metastatic and 100% of lymphoma, RI is less than 1.5 where as 66% of tubercular adenitis , 50% of reactive adenitis , 100% of nonspecific adenitis have RI>2.

In the study by A. Ahuja et al [18] majority of malignant nodes were hypoechoic and heterogeneous. However they found that hyperechoic metastatic nodes in papillary carcinoma of thyroid. In the present study 100% of metastatic nodes are hypoechoic and heterogeneous in which some of the metastatic nodes are from papillary carcinoma. Dietmar kaishwitz et al[4] reported that lymph nodes were

hypoechoic to anechoic and homogenous in lymphoma.In this study 66% of lymph node in lymphoma are anechoic and 33% are hypoechoic with 100% are homogenous. Baatenburg et al[21] reported the spectrum ranging from echogenic to anechoic lymphnode in tubercular adenitis. In the present study, 83% of the tubercular nodes are hypoechoic and heterogeneous , 17% are anechoic and homogenous .A Ahuja et al[18] reported 100% lymph nodes to be hypoechoic and homogenous in reactive lymphadenitis. In present study only 50% of lymph nodes are hypoechoic in reactive adenitis.Dietmar kaishwitz et al[4] reported hypoechoic and homogenous nodes in non specific lymph adenitis. In the present study also 100% nodes are hypoechoic and homogenous.

Dietmar kaishwitz et al[4] reported loss of hilar definition in malignant lymph nodes.In the present study 100% of metastatic and 100% of lymph nodes in lymphoma also show loss of hilar definition.Baatenburg et al[22] reported loss of hilar definition in tubercular adenitis in their study. In the present study 100% of tubercular adenitis shows loss of definition. A. Ahuja et al[18] reported that nodal hilus is preserved in reactive adenitis but in present study only 50% have preserved hilus.Dietmar kaishwitz et al[4] reported in their study that hilus is not always apparent in nonspecific adenitis .In present study hilus is absent in 100% cases.

Calcification within the cervical nodes is unusual and most often has been reported with previous granulomatous infection(Som et al 1987, Salbiati et al 1992).Som etal[48]described that metastatic tumoral calcification is uncommon and commonest likely primary neoplasm is papillary carcinoma of thyroid. In the present study 37% of metastatic lymphnodes show calcification (all cases from papillary carcinoma of thyroid). Schwerk et al in 1985 and Gormen et al in1987 also reported presence of calcification in cervical lymph nodes from medullary carcinoma of thyroid .In the study by Majer MC et al[49] calcification was not noted in nodes from lymphoma. In the present study also no calcification noted in nodes from lymphoma. Study by Schwerk et al[50] showed calcification in 62% of TB adenitis .In the present study calcification is present in 66% of TB adenitis. Calcification in reactive adenitis and non specific adenitis is not reported in literature and in present study also it is not present.

Muraki et al reported cystic necrosis in metastatic lymphnode from squamous cell carcinoma .Som et all[48] also reported cystic necrosis in metastatic lymphnode from papillary carcinoma. In the present study 62% of the metastatic lymphnodes shows cystic necrosis of which 66% are from papillary carcinoma of thyroid remaining others have unknown origin. Baatenburg et al[21] reported cystic necrosis in tubercular lymphnode. In the present study 50% of Tb lymph node shows cystic changes. Cystic changes are not reported in reactive and non specific lymph adenitis in literature. In present study also no cystic necrosis has been noted in these type of lymphadenitis.

The study by A. Ahuja et al[19] showed that 100% of lymph nodes were matted and had irregular border in TB adenitis. In present study also 100% lymphnodes are matted and had irregular border. Dietmar Kuischwitz et al [4] reported matted lymphnodes in 66% cases.

Dietmar Kuiscwitz et al[4] reported that 40% of cases of lymphoma had posterior enhancement .In present study 100% of cases of lymphoma show posterior enhancement.

In overall malignant (metastatic and lymphoma) lymph nodes predominantly (62%) are spherical shaped (RI<1.5) and inflammatory lymph nodes predominantly (66%) are longitudinal in shape. Metastatic lymph nodes are predominantly spherical (87%), hypoechoic (80%), sharply marginated (87%) with cystic necrosis (62%) and absent hilum (100%).Few may show calcification (37%) and great vessels encasement (25%).In lymphoma, lymph nodes are predominantly spherical (100%), anechoic with posterior enhancement (100%), calcification (66%) and absent hilum (100%).

Tubercular lymph nodes are predominantly longitudinal (66%), hypoechoic (83%), heterogeneous (83%), matted (100%) with calcification (66%) and absent hilum (100%).

Reactive and nonspecific lymph adenitis is predominantly longitudinal, hypoechoic, and sharply marinated.

Lipomas are the most common benign mesenchymal tumor arising in any location where fat is normally present. Thirteen percent of all lipomas are located in head and neck region.[51]

A. T. Ahuja , A. D. King et al[52] reported from their study that lipomas were well-defined (88%),compressible(100%),contain multiple echogenic lines parallel to the skin surface (100%). They also reported that there were no posterior enhancement and no flow on Doppler study. They also found that 76% of all lipomas were hyperechoic 16% were isoechoic and 8% were hypoechoic.Gitzman et a[53] reported that lipomas had striped appearance and were echogenic in nature. In the present study 100% lipomas are elliptical shaped and only 60% are well defined. 80% are compressible and all (100%) are hyperechoic with echogenic lines parallel to skin surface. Posterior enhancement is not seen in any case.

In the present study characteristic sonographic appearance of lipomas are hyperechoic elliptical masses with echogenic lines parallel to skin surface which are compressible.

The thyroglossal cyst is the most common developmental cyst in the neck, accounting for 70% of all congenital neck lesion[54] A.T.Ahuja, A, A. D.King et al[55] reported that 82.6% lesion were located in midline and 11.7% were off- midline ,47.8% were infrahyoid , 47.8% at the level of hyoid and 4.4 %was suprahyoid.In their study they found 82.6% lipomas have thin wall and 17.4% were thick – walled. They also found that 100% of lipomas were mariginated, 13% were truly anechoic, 56.5% were hyperechoic and had a pseudosolid appearance, and 30.5% were heterogeneous. In the present study 56.5% shows posterior enhancement .In another study by Wadsworth et al[56] found 41.7% lesion were anechoic (of this hypoechoic lesion 71.4% showed a complex heterogeneous pattern. In the present study all thyroglossal cyst are in mid line, 75% suprahyoid and 25% infrahyoid . 50% have thin wall and 50% have thick wall. 75% of cyst in present study are anechoic and 25% hypoechoic .75% of cyst are homogenous.1 out of 4 cases(25%)show mural nodule . Posterior enhancement is present in 50% cases.
In the present study sonographic appearance of thyroglossal cyst are variable but predominantly they are midline, suprahyoid, anechoic, homogenous cystic lesions.

Cystic hygroma are rare benign tumors that results from a congenital blockage of regional lymphatic drainage.[57] Sheila sheth et al [58] reported sonographic finding in eight children with surgically proved cystic hygroma.In their study they found that cystic hygroma were multilocular cystic mass and contained septa of variable thickness and all had solid echogenic component of variable size. In children various sonographic appearances have been reported although septation has been described as characteristic of these tumors.[57] In the present study out of three cases of cystic hygroma, two cases (66%) are multiloculated cystic mass of variable septation and 1 case (33%) is anechoic with thin septa.

Pleomorphic adenoma is the most frequent tumor of the salivary gland (24 to 71%).[65] Dietmar Koischwitz et al[4] described sonographic features of tumor as well defined, homogenous, hypoechoic area but they also noted hyperechoic and sometimes cystic changes and calcifications. In the present study both the cases are hypoechoic, homogenous and sharply marginated. One case shows cystic changes.Warthin's tumor (cystaadenolymphoma) is USG differential diagnosis of Pleomorphic adenoma. Sonographic features of this tumor are hypoechoic, homogenous cystic lesion but it generally has multiple septa.[59]

Richard Kraus et al[11] reported variable sonographic features of Hemangiomas. In their study, they found that these were mild to moderately echogenic. In this study one case showed several, small anechoic areas suggesting vascular spaces. Another case showed echogenic linear septation and calcification. In the present study, 2 cases of Hemangioma showed several, small anechoic areas with echogenic linear septation and calcification.

In the present study one case of neck swelling had already undergone FNAC before USG, as on the physical examination itself the swelling was considered to be an enlarged lymph node. Lorenzo E.et al[60] reviewed 23 cases of carotid body tumor and they described sonographic findings of carotid body tumor. They found that lesions were slightly heterogeneous and were located within the carotid bifurcation. Doppler showed blood flow within the tumor masses. In the present study the mass was heterogeneous and was found in carotid bifurcation with increased vascularity.The study shows that the most important criteria for diagnosis is its anatomical location within the carotid bifurcation.

Recent literatures have described different soncgraphic findings of various neck masses. Now USG is commonly used as the first imaging modality which provides valuable diagnostic information.

SUMMARY

Neck swelling is a common clinical problem which needs proper surgical or medical management. High resolution B mode sonography in the past few years has become a very valuable tool in the diagnosis of diseases of the neck.

The present study shows various sonographic characteristic features of various neck masses.
On the basis of site of origin, neck masses were classified into three broad groups:
1. Thyroid masses
2. Lymphnodal masses
3. Other neck masses

On the basis of various USG findings like shape, internal contents, echogenicity, margins, calcification, cystic changes, posterior enhancement and flow pattern diagnosis of neck masses were given which were compared with pathological diagnosis for knowing its accuracy.

USG had

a) 100% sensitivity and 91%specificity in differentiating benign from malignant thyroid nodule.
b) 100% sensitivity and 66% specificity in giving various causes of diffuse enlargement of thyroid gland.
c) 100% sensitivity and 81%specificity in differentiating benign from malignant enlarged cervical lymph nodes.

Sonographic features of other neck masses (lipomas, thyroglossal cyst, cystic hygroma, Hemangioma, Pleomorphic adenoma of parotid gland, carotid body tumor) is also valuable in making their diagnosis.

CONCLUSIONS

1. On the basis of anatomical site of origin intrathyroid neck masses are more common than extrathyroid neck masses.

2. Shape, internal contents, echogenicity, margins, calcification, cystic changes, peripheral halo, posterior enhancement and flow patterns are important sonographic finding for the diagnosis of neck masses.

3. USG is a sensitive and specific imaging modality in the diagnostic work up of patients with neck masses.It is also useful in providing information about relationship to the surrounding structures.

BIBLIOGRAPHY

1. Luigi Solbiati, Vincenzo cioffi et al: ultrasonography of the neck RCNA vol 30, no 5, sept 1992.
2. Eeic Schwetchemu , Daniel J. Kelly : neck masses , Journal of American academy of family physicans, sept 2002
3. Neck masses, American academy of atolaryngology- Head and neck surgery
4. Dietmar Kuischwitz, Norvert Gitzman et al: ultrasound of neck, RCNA vol 38, no. 5 sept 2000.
5. Gooding GA, Herzog KA, Laing FC et al: ultrasonographic assesement of neck masses. Journal of clinical radiology 1997 Aug : 5(4) : 248- 52
6. Chodosh PL, Silbey R et al : Diagnostic use of ultrasound in disease of the head and neck.Laryngoscope 1980 may , 90 (sept2) : 814-71
7. Baker SR, Krause CJ et al : Ultrasound analysis of head and neck neoplasms correlation with surgical finding
8. Friedman AP. Haller JO, Goodman JD et al: inflammatory neck masses in children. Radiology 1983 Jun: 147(3) : 693-7
9. Subramanyam BR et al: sonographic demonstration of bulking of great vessels of the neck masses. AJR 1984 Jun 142(6):1111-3
10. Sherman NH, Rosenberg HK et al: Ultrasound evaluation of neck masses in children. Journal of ultrasound 1985 mar 4 (3) : 127-34
11. Kraus R, Han BK et al : sonography of neck masses in children.AJR 1986 mar : 142(6): 146(3): 609-13
12. Gianfelice D. Jeguier S, Patriguin H et al: somography of neck masses in children: is it useful? Int. J Ped. Otorhinolarynglo 1986 sep:11(3): 247-56
13. Sheila Sheth et al: cystic hygromas in children. Sonographic pathological correlation. Radiology 1987 162: 821-824.
14. Gonczi J , Goblyos P et al : Role of ultrasound in differential diagnosis of neck masses.Rontgenblatter 1988Nov , 41(11) 452-7
15. Lorenzo E et al : Carotid body tumor : US evaluation ; head and neck radiology , feb 1992 vol 182 ;457-459
16. Bergami G, Napps et al: Ultrasonic diagnosis of "hematoma" of sternocleidomastoid muscle. Radio logy 1995 Jun 89 (6):766-8
17. P.A. K. set et al: sonographic feature of Hashimoto thyroiditis in children. Clinical radiology (1996) 51, 167-169
18. A. Ahuja , M. Ying et al : The use of sonography in differentiating cervical Lymphomatous lymph nodes from cervical metastatic lymph nodes; Clinical radiology(1996) 186-190
19. A. Ahuja, M. Ying et al: A practical approach to USG of cervical lymphnode. The journal of laryngology and otology. March 1997 vol111; 245_256
20. A.T. Ahuja, A.D. King et al: Head and neck lipomas: sonographic appearance. AJNR Am Neuroradiol 19:505-508, March 1998
21. Baatenburg be Jong RJ, Ronngen RJ et all: Ultrasound in the diagnosis of cervical tubercular adenitis.Auris Nasus Larynx 1998 Jan ,25 (1) 67-72

22. A.T.Ahuja, A, A.D. King et al: Sonographic evaluation of thyroglossal duct cysts in children. Clinical radiology (2000) 55 770-774.
23. Sajeeba S, Panda N, et al: The role of ultrasound in management of tumors of neck. Ear Nose Throat J 2000Aug , 79 (8):586-9
24. Pankaj Gupta et al: preoperative sonography in presumed Thyroglossal duct cysts.Archotlaryngol head neck sugery, vol 127, Feb 2001.
25. LTC John A, Jr et al : evaluation of extrathyroid masses of the head and neck with Gray scale Ultrasound.; Arch otolaryngol vol 106, feb 1980
26. Anurag Jain et al: Thyroid carcinoma –spectrum of high resolution sonography and color Doppler flow imaging.
27. Richard Kraus et al : Sonography of neck masses in children : ARJ march 1986
28. Ciatti .S et al: Current state of thyroid ultrasound. annual ultrasound 1984, 261-284
29. Rojeske MT et al ; nodular thyroid disease:N Engl J Med 1985, 313;428-236
30. Hennemann G. et al : Nox toxic goiter .cli Endocrinal Metab 1979;8;167-179
31. Holtz S et al: calcification in papillary carcinoma in thyroid.Radiology 1958;80;997-1000
32. Luigi Solbiati et al : The thyroid gland, Diagnostic ultrasound vol1,703-755
33. Solbiati L., Livraghi T et al : Thyroid gland, ultrasound of superficial structure, 1995 49- 85
34. Hammer M , Wortsman J et al : cancer in ctstic lesion of thyroid, Arch surg 1982; 117; 1020-1023
35. Solbiati L,Volterrani et al: contribution of color flow mapping to. the differential diagnosis of the thyroid nodules, 1991
36. Lagalla R et al: Echo Doppler coyleur et pathologic thyroidienne.JEME1992;13;44-47
37. Argalia G, spiezia S et al : Doppler nella diagnostica dei noduii tiroidei Radiol med 1995; 651-657
38. Poyhonen L, Lenko et al: ultrasound imaging in diffuse thyroid disorders of children. Acta paeditrica scandinavica 1986,103;273- 278
39. Bachrach LK, DanemanD et al: use of ultrasound in childhood thyroid disease and adolescence. Journal of pediatrics 1983, 103, 547-552
40. P.A. K. set et al : sonographic feature of Hashimoto Thyroiditis in childhood, the royal college of radiologists 1996
41. Yeh HC et al : ultrasonographic sign of Hashimoto's thyroiditis, J of ultrasound med 1996,15;813-819
42. Bachrach LK et al : ultrasound in childhood thyroid disorders, Journal of pediatrics 1983;103:547-552
43. Brander A et al : Thyroid gland, Radiology 1989;19;545-576
44. Adams H et al : ultrasound appearances of de Quervain's thyroiditis.clinical radiology 1990, 42; 217-218
45. Brichall IWJ et al : ultrasound appearance of de Quervain's thyroiditis.clinical radiology 1990 ,41,57-59

46. Koischwitz et al : sonographie der Kopf-Hal_ region.Berlin, spring 1993
47. Solbitati L et al: high resolution sonography of cervical lymph nodes in the head and neck cancer. Criteria for differentiation of reactive versus malignant nodes. Radiology 169: 133, 1988
48. Som P. M. (1987) Lymph nodes of the neck. Radiology 165,593-600
49. Major MC et al: A specific US sign of lymphomatous involvement. Radiology 168: 241-243
50. Schwerk et al: ultrasound diagnosis of C-cell carcinoma of thyroid. Cancer55, 624-630
51. Barnes et al: Tumors and tumor like lesions of head and neck: surgical pathology of head and neck. NY, 1985; 747-757
52. A. T. Ahuja et al : head and neck lipomas : sonographic appearance AJNR Am J 19;505-508 march 1998
53. Gritzman et al: sonography and computed tomography in deep cervical lipomas and lipomatosis of the neck. J ultrasound med1988:19;215-220
54. Santiago et al: Thyroglossal duct cyst of the tongue. J otolaryngol 1985;14;261-264
55. A. T. Ahuja et al : sonographic evaluation of thyroglossal duct cysts in children, The Royal college of radiologist ,2000
56. wadsworth DT et al : Thyroglossal duct cysts, variability of sonographic finding.AJR 1994; 163;1475-1477
57. Kraus R et al : sonography of the neck masses in children AJR 1986;146;609-613
58. Sheila sheth et al : Cystic hygromas in children : sonographic – pathological correlation; Radiology 1987;162;821-824
59. Schroeder HG et al : High resolution real time sonography in diseases of salivary gland; part II tumor HNO 33: 511-516,1988
60. Lorenzo E et al: Carotid body tumor: us evaluation, Radiology 1992, 182, 457-459.

APPENDIX

PATIENT'S INFORMATION SHEET

Name: Date:

Age\sex:

Hospital no.

CLINICAL HISTORY

EXAMIATION FINDINGS

CLINICAL DIAGNOSIS:

LABORATORY TEST (If Any)

USG NECK

- Finding:

- USG diagnosis

CYTOPATHOLOGICAL\ HISTOPATHOLOGICAL FINDING

CYTOPATHOLOGICAL\ HISTOPATHOLOGICAL DIAGNOSIS