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ORIGINAL RESEARCH

TO DETERMINE THE EFFICACY OF ULTRASOUND IN THE DIAGNOSIS OF NECK SWELLINGS

[1]Dr SeemaPandey, [2]Dr Neetu Singh, [3]Dr Mahendra Mehta, [4]Dr Sunil Sanga

[1]Associate Professor, Department of Radiodiagnosis, MLN Medical College, Prayagraj, Uttar Pradesh, India

[2]Consultant, Department of Radiodiagnosis, Kriti Scanning Centre, Prayagraj, Uttar Pradesh, India

[3]Assistant Professor, Department of ENT, Zydus Medical College and Hospital, Dahod,Gujarat, India

[4]Associate Professor, Department of Radiodiagnosis, Adesh Medical College and Hospital, Shahbad,Ambala,Haryana, India

Correspondence:

Dr Sunil Sanga

Associate Professor, Department of Radiodiagnosis, Adesh Medical College and Hospital, Shahbad, Ambala, Haryana, India

Email:sunilsanga@rediffmail.com

ABSTRACT

Aim: To determine the efficacy of ultrasound in the diagnosis of neckswellings.

Methods: This research comprised 50 instances with clinically evident swellings in the neck area. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of ultrasonography diagnosis were assessed for each group of neck swellings. The sensitivity analysis for such a tiny number is invalid since there were only three congenital swellings.

Results: Our research comprised patients of various ages, with a minimum age of 25 days and a maximum age of 82 years, with a mean age of 37.5 years. In our research, 15 (30%) of the patients were men, whereas 35 (70%) were girls. According to the research, about two-thirds (32) of neck swellings were solid, 5 were cystic, and 13 swellings contained both solid and cystic components. In our investigation, 64% of clinically firm swellings were determined to be solid, whereas the rest were either completely cystic or mixed in nature. This research found that the Sensitivity, Specificity, PPV, and NPV of the US for inflammatory swellings are 87 percent, 97 percent, 95 percent, and 92 percent, respectively. The sensitivity analysis of clinical diagnosis and ultrasound diagnostic for inflammatory swellings.The sensitivity of US in identifying malignant lesions of the neck in 50 patients with neck swellings was 87 percent in this research, with a specificity of 99 percent, PPV 93 percent, and NPV 97 percent.

Conclusion: US can tell the difference between solid and cystic neck swellings, as well as malignant and benign neck swellings. It may detect thyroid, salivary gland, and lymph node lesions, as well as differentiate between abscess and cellulitis.
Keywords: ultrasound,neckswellings, malignant, benign

INTRODUCTION

"Sonography" refers to ultrasonic imaging; "ultra" denotes beyond or in excess; and "sound" refers to audible sound energy. The word ultrasonic refers to a kind of sound energy that is above the hearing range. Ultrasound for diagnostic purposes has a frequency range of 2 MHz-20 MHz, but ultrasound for ophthalmology has a frequency range of 2 MHz-50 MHz.[1,2] Ultrasound is a kind of longitudinal mechanical wave that requires a medium to transfer from one location to another. Vibrating piezoelectric crystals are used to generate ultrasonic waves by applying a high-frequency electrical pulse to trigger mechanical vibration. As a result, electrical energy is transformed into mechanical energy. Diagnostic ultrasonography employs a transducer that produces a narrow focus beam. This beam is reflected by the tissue and returned to the same transducer, which assembles the echoes into a picture that can be seen and recorded.[1,2] Ultrasonography offers various benefits over other modalities, including the fact that it is non-invasive, does not require ionising radiation, is widely accessible, simple to use, non-invasive, affordable, and is unaffected by metal artefacts such as dental restorations. It is possible to execute it without sedation. Ultrasound has no health risks and may be performed as many times as required.

On-screen nodal measurement is available in ultrasonography.[3] Ultrasound can distinguish cystic from solid lesions and can also assist distinguish between malignant and benign tumours. It is useful in determining the existence of numerous lymph nodes and the course of infectious illness resolution. It's utilised to see whether there are any face abscesses and how big they are. It may be utilised to detect the existence of regional lymph node metastases in instances of mouth cancer. Ultrasound may be used to identify sialoliths and diagnose problems with the salivary gland. CT is utilised to visualise the parapharyngeal space.[4] Various illness processes that manifest clinically as swellings might affect the head and neck areas. The illness processes that cause such swellings may be generically characterised as inflammatory, cystic, benign, or malignant.

The most significant and obligatory measures in evaluating such swellings are a complete case history and a clinical examination. Clinical examination and palpation, however, may not offer a thorough evaluation of the actual origin and type of swellings in certain circumstances, such as chronic inflammation, abscess development, deep-seated or infected cystic lesion, and neoplasms; such cases need radiological imaging. As a result, clinical examination must be combined with numerous investigative methods to get a definitive diagnosis.

METHODS AND MATERIALS

After obtaining ethical approval, this research was conducted. This research comprised 50 instances with clinically evident swellings in the neck area. Patients with swellings produced by trauma or fracture were not included in the research because clinical identification of haematoma would not be a problem due to a history of trauma and changes in skin colour and

mucous membrane, and swellings covered by jaw bone were omitted. The research included patients with swellings in the neck area. All patients provided previous informed consent. A comprehensive case history was taken for each patient, and a clinical examination was performed. A general physical examination and a local examination were performed in accordance with the criteria outlined in Dr. S. Das' "A handbook on clinical surgery." In the instance of several swellings, the greatest swelling was taken into account for the research. Color, form, size, border, surface, and covering skin above the bulge were all noticed throughout the examination. Palpation was used to record the consistency, tenderness, warmth, fluctuation, compressibility, and fixity of the skin above the edoema. The collected data was entered into a systematic proforma for documenting clinical observations, and a preliminary diagnosis was produced. Swellings were classified into four classes based on clinical diagnosis:

1. Congenital enlargements
2. Inflammatory edoema
3. Noncancerous neoplasms
4. Cancerous neoplasms

Following a provisional diagnosis, patients were subjected to preliminary tests that included haemoglobin, total leucocyte count, differential leucocyte count, and erythrocyte sedimentation rate. Thyroid function tests were also performed on patients who had thyroid swellings (Serum T3, T4 and TSH). Neck ultrasound was performed in supine position with neck hyperextended using a 7-12 Hz linear probe. According to Shimizu et al., the following characteristics were examined when characterising US pictures of edoema in the head and neck. Following clinical and ultrasound examination, an ultrasonographic diagnosis was established, and patients were divided into the four categories described above. Finally, the patient had FNAC or further imaging or surgical intervention, which included incision and drainage or excision/incisional biopsy with histological analysis. A final determination was made. A blood picture was taken in instances of inflammatory swellings, and the final diagnosis was made based on the response to either surgical intervention, i.e. incision and drainage, or effective non-surgical therapy. The collected data was collated and statistically analysed. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of ultrasonography diagnosis were assessed for each group of neck swellings. The sensitivity analysis for such a tiny number is invalid since there were only three congenital swellings.

RESULTS

Our research comprised patients of various ages, with a minimum age of 25 days and a maximum age of 82 years, with a mean age of 37.5 years. In our research, 15 (30%) of the patients were men, whereas 35 (70%) were girls. The swellings were classified as congenital, 12 inflammatory, 31 benign, and 6 malignant after a complete clinical examination and preliminary investigations, which included blood testing and thyroid function tests. In the United States, two swellings were discovered to be congenital, 15 to be inflammatory, 23 to be benign neoplasms, and 8 to be malignant. On US, two swellings that were clinically identified as benign thyroid swellings were discovered to be normal variations with asymmetrical thyroid lobes. There were two congenital swellings, 18 inflammatory, 21

benign, and seven malignant neck swellings at the time of the final diagnosis. The first table compares ultrasound diagnostic to final diagnosis.

Table 1: Ultrasound diagnosis as compared to final diagnosis

Type of swellings	US diagnosis		Final diagnosis	
	No.	%	No.	%
Congenital	2	4	2	4
Inflammatory	15	30	18	36
Benign	23	46	21	42
Malignant	8	16	7	14
No abnormality	2	4	2	4
Total	50	100.0	100	100.0

According to the research, about two-thirds (32) of neck swellings were solid, 5 were cystic, and 13 swellings contained both solid and cystic components. The bulk of the solid swellings, 22 in total, were thyroid swellings. There were 10 lymph nodes and the rest were lipoma, benign epithelial lesions, and salivary gland lesions (submandibular sialadenitis and parotid tumours). Two of the cystic lesions were thyroid-related, one was a benign epidermal cyst, one was a cervical ranula, and the rest were abscesses. In our investigation, 64% of clinically firm swellings were determined to be solid, whereas the rest were either completely cystic or mixed in nature. This research found that the Sensitivity, Specificity, PPV, and NPV of the US for inflammatory swellings are 87 percent, 97 percent, 95 percent, and 92 percent, respectively. The sensitivity analysis of clinical diagnosis and ultrasound diagnostic for inflammatory swellings is compared in Table 2.

Table 2: Sensitivity analysis of inflammatory neck swellings

Sensitivity analysis	Clinical diagnosis (%)	US diagnosis (%)
Sensitivity	56	87
Specificity	95	97
PPV	89	95
NPV	77	92

Our investigation found a total of 21 benign lesions in the neck, with the US properly identifying 20 of them. In this scenario, the Sensitivity, Specificity, PPV, and NPV of the United States were 97 percent, 91 percent, 89 percent, and 98 percent, respectively. The sensitivity analysis of clinical diagnosis and ultrasound diagnostic for benign swellings is compared in Table 3.

Table 3: Sensitivity analysis of benign neck swellings

Sensitivity analysis	Clinical diagnosis (%)	US diagnosis (%)
Sensitivity	94	97
Specificity	51	91
PPV	53	89
NPV	94	98

The sensitivity of US in identifying malignant lesions of the neck in 50 patients with neck swellings was 87 percent in this research, with a specificity of 99 percent, PPV 93 percent, and NPV 97 percent. In the current research, the sensitivity of the US in identifying thyroid cancer was 83%. In this investigation, the sensitivity of US in detecting malignant lymph nodes was 87 percent. The sensitivity analyses of clinical diagnosis and ultrasonography diagnostic for malignant swellings are compared in Table 4.

Table 4: Sensitivity analysis of malignant neck swellings

Sensitivity analysis	Clinical diagnosis (%)	US diagnosis (%)
Sensitivity	44	87
Specificity	100	99
PPV	100	93
NPV	90	97

DISCUSSION

The doctor must be able to use systematic, efficient diagnostic approaches to discover the cause of a neck tumour. [5,6]Because malignancy is the major concern in adults with a persistent neck tumour, the initial priority is to ascertain whether the mass is malignant or benign. Adult smokers over the age of 40 are more likely to get cancer. [6] If a history and physical examination do not reveal a clear reason, imaging and surgical techniques may be useful. [6] In the majority of instances, US with or without FNAC will make the diagnosis. [5]

The average age was 37.5 years old. In our research, 15 (30%) of the patients were men, whereas 35 (70%) were girls. Following a complete clinical examination and preliminary investigations, including blood tests (Haemoglobin, TLC, DLC) and thyroid function tests (T3, T4, and TSH), the swellings were classified into four groups: one congenital, twelve inflammatory, 31 benign, and six malignant. In the United States, two swellings were discovered to be congenital, 15 to be inflammatory, 23 to be benign neoplasms, and 8 to be malignant. On US, two swellings that were clinically identified as benign thyroid swellings were discovered to be normal variations with asymmetrical thyroid lobes. There were two congenital swellings, 18 inflammatory, 21 benign, and seven malignant neck swellings at the time of the final diagnosis. This is consistent with past research of this kind. [7,8]

The prevalence of neck abscess has reduced with the introduction of antibiotics.[9]An abscess occurs in the United States as an ill-defined, irregular fluid collection with thick walls and interior material. [9]Oedema may occur in the neighbouring soft tissue and subcutaneous layer. [9] Similar to Mukhi and Mahindra's research, the US image in cellulitis exhibited an ill-defined hyperechoic heterogeneous mass, while neck abscesses showed smooth well-defined hypoechoic lesions with posterior echoes. [10] Clinically, two of the five acute inflammatory swellings appeared as abscesses, one of which was shown to be an abscess on US and was later drained, while the other was proven to be cellulitis on US. On US, one lump that seemed to be cellulitis was instead detected as an abscess. As a result, US may establish the existence of abscess development and aid in diagnosing the stage of infection, outperforming clinical examination in distinguishing cellulitis from abscess. This eliminates the need for needless draining of cellulitis, which may be treated conservatively with antibiotics. [10-12]

Most benign neoplasms in our investigation showed extremely obvious borders, hypoechoic echo intensity, and a solid character, which is consistent with the findings of Chandaket al.[13] However, our research found that most benign lesions were heterogeneous, while the same study found that the majority of benign neoplasms in the United States were homogenous. [13] Seven of the swellings were eventually determined to be cancerous. Two were thyroid cancers, three were metastatic lymph node cancers, one was Hodgkin's lymphoma, and one was parotid cancer. For patients with suspected head and neck cancer, the entire neck must be evaluated, including nodal drainage sites, lymph nodes must be assessed to identify often subtle features indicative of abnormality, typical features of common non-nodal pathologies must be appreciated, and normal structures that may mimic neck lumps must be recognized.[5]
According to Khanna et al., metastatic lymph nodes in our research were spherical in form with hypoechoic echo intensity.[14] According to a study of 79 patients in Korea, the majority of tuberculous lymph nodes were hypoechoic and heterogeneous, with necrosis on US. 15 As previously reported, the key differentiating characteristic of lymph nodes in a case of lymphoma in our investigation was a homogenous pattern.[14] The majority of thyroid malignant neoplasms in this research were hypoechoic, which is consistent with prior investigations.[16,17]Because surgery is the basis of therapy for malignant thyroid disease, determining whether the illness is benign or malignant prior to surgery enhances the surgical prognosis. Furthermore, high-resolution sonography may be used to guide FNA/biopsy procedures as well as percutaneous treatment of non-functioning or hyperfunctioning benign thyroid nodules and lymph node metastases from papillary cancer. [18]
According to the research, about two-thirds (32) of neck swellings were solid, 5 were cystic, and 13 swellings contained both solid and cystic components. The bulk of the solid swellings, 22 in total, were thyroid swellings. There were 10 lymph nodes and the rest were lipoma, benign epithelial lesions, and salivary gland lesions (submandibular sialadenitis and parotid tumours). Two of the cystic lesions were thyroid-related, one was a benign epidermal cyst, one was a cervical ranula, and the rest were abscesses. In our investigation, 64% of clinically firm swellings were determined to be solid, whereas the rest were either completely cystic or mixed in nature.
In a study of 30 patients with neck swellings, only 60% of single clinically firm/solid swellings were revealed to be cystic, with supplemental US assessment assisting in confirming their real cystic nature in 40% of such instances.[19] In our research, cystic lesions in the United States were presented as homogeneous anechoic solely cystic lesions, which correlated well with prior investigations.[13] This research found that the Sensitivity, Specificity, PPV, and NPV of the US for inflammatory swellings are 87 percent, 97 percent, 95 percent, and 92 percent, respectively. Our investigation found a total of 21 benign lesions in the neck, with the US properly identifying 20 of them. In this scenario, the Sensitivity, Specificity, PPV, and NPV of the United States were 97 percent, 91 percent, 89 percent, and 98 percent, respectively. A research by Chandak et al found similar findings, with sensitivity and specificity of 100 percent and 98 percent, respectively. The United States can predict malignancy in 89 percent of instances, but distinct types of malignancy cannot be distinguished. [13]
The sensitivity of US in identifying malignant lesions of the neck in 50 patients with neck swellings was 87 percent in this research, with a specificity of 99 percent, PPV 93 percent,

and NPV 97 percent. The findings are consistent with a research that looked at 42 patients with malignant neoplasms in the head and neck area and found sensitivity, specificity, PPV, and NPV of 96.8 percent, 93.3 percent, 96 percent, and 93 percent, respectively. [20] The overall sensitivity of thyroid US for identifying a malignant nodule in the current research was 81.8 percent, which was comparable to a study of 203 patients from September 2009 to August 2010 in which the overall sensitivity of thyroid US for diagnosing a malignant nodule was 81.8 percent. [21] As a result, the United States has a high sensitivity and specificity in identifying all forms of neck swellings, including congenital, inflammatory, benign, and malignant.

CONCLUSION

US can tell the difference between solid and cystic neck swellings, as well as malignant and benign neck swellings. It may detect thyroid, salivary gland, and lymph node lesions, as well as differentiate between abscess and cellulitis. It outperforms clinical evaluation in the diagnosis of all kinds of neck swellings. Histopathology and US results correspond well. The use of ultrasound in the neck offers various benefits over other imaging modalities. It is non-toxic, radiation-free, generally available, accessible, non-invasive, and inexpensive, and it is unaffected by metal artefacts. It does not need sedation. It has no long-term negative effects and may be repeated as many times as needed.

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