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Ultrasonographic Characterization of Jaw Swellings- A Systematic Review

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Background:*Various disease processes may affect head and neck regions, which present clinically as swellings. The disease processes which lead to such types of swellings can be broadly classified as inflammatory, cystic, benign or malignant in nature. In evaluation of jaw swellings, detailed case history and clinical examination are the most important and mandatory steps[1].*

But in some cases, such as chronic inflammation, abscess formation, deep-seated or infected cystic lesion and neoplasm, clinical examination do not provide complete assessment of the exact origin and nature of swellings; such cases require radiological imaging. Therefore, to get a final diagnosis, clinical examination must be joined with various investigative procedures. Hence ultrasonographyused to diagnose the different kind of jaw swellings.[1]

In this review sensitivity, specificity, predictive value,and accuracy of the ultrasonography diagnosis were calculated in inflammatory, cystic, benign and malignant swellings.

Aim and Objective: *To assess the reliability and accuracy of ulrasonography as a diagnostic aid in jaw swelling*

To determine the accuracy, sensitivity,specificity and prediction values of ultrasound as means of diagnosis of jaw swellings.

Search strategy: *The following electronic retrieval systems and databases were searched for identification of studies. The Cochrane Central Register of Controlled Trials (CENTRAL) PUBMED, MEDLINE, SCIENCE DIRECT.*

Search criteria: *Studies conducted in human study with clinical parameters which evaluated in the jaw swellings based on their echo intensity of jaw swellings.*

Main results: *Four studies were included in this review among all fourstudies, two studies only determined the accuracy,sensitivity,specificity and predictive values of ultrasonography diagnosis in jaw swellings. One study determined only the sensitivity and specificity; another study determined only the percentage of ultrasonography diagnosis.*

Conclusion: *Ultrasonography can be used as a diagnostic aid in jaw swellings.But Quality studies which assesing the diagnostic accuracy, sensitivity and specificity are less.To conclude, quality studies are needed to establish whether the ultrasonography diagnosis is accurate in all jaw swellings.*

I. Introduction

Various disease processes may affect head and neck regions, which present clinically as swellings. The disease processes which lead to such types of swellings can be broadly classified as inflammatory, cystic, benign or malignant in nature. In evaluation of jaw swellings, detailed case history and clinical examination are the most important and mandatory steps.[1]

But in some cases, such as chronic inflammation, abscess formation, deep-seated or infected cystic lesion and neoplasm, clinical examination do not provide complete assessment of the exact origin and nature of swellings; such cases require radiological imaging. Therefore, to get a final diagnosis, clinical examination must be joined with various investigative procedures[1]

The physical examination of jaw swellings lacks the diagnostic accuracy hence various investigations been introduced to evaluate the jaw swellings the ultrasonography been one of the recent tools.[2]

Ultrasonography has several advantages over other modalities as it is harmless, uses no ionizing radiation,is widely available, easy-to-use, non-invasive, in expensive and unaffected by metal artefacts such as dentalrestorations. It can be performed without heavy sedation.Ultrasound causes no health problems and maybe repeated as often as necessary.[4]

The sonographic images are identified in the terms of echoes as hypoechoic,hyperechoic and anechoic a mass is hypoechoic it has a intensity lower than that of the adjacent tissues,hyperechoic is used for the mass of higher intensity,andisoechoic is used for the masses shows intensity similar to that of adjacent tissues.[4]

Structured Question

Are ultrasounds accurate in diagnosing the different varieties of jaw swellings?
What is specificity and sensitivity of ultrasound in diagnosing the jaw swellings?

II. Materials And Methods

Source

A comprehensive literature search of the following databases were done which included studies of
The Cochrane Central Register of Controlled Trials (CENTRAL)
PUBMED
MEDLINE
SCIENCE DIRECT
We also searched websites of products manufactures, as well as Google scholar.
PUBMED

Search Methodology: (PUBMED)

Search	Add to builder	Query	Items found	Time
#39	Add	Search (((#32) AND #33) AND #34) AND #35 Filters: Humans; English	85	06:15:32
#38	Add	Search (((#32) AND #33) AND #34) AND #35 Filters: Humans	100	06:13:22
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#29	Add	Search sensitivity specificity	432285	05:21:34
#28	Add	Search specificity	860826	05:21:20
#27	Add	Search specificity diagnosis	444504	05:21:03
#26	Add	Search specificity sensitivity	432285	05:20:31
#25	Add	Search sensitivity	826901	05:19:42
#24	Add	Search echogenic	3338	05:19:25
#23	Add	Search echo intensity	4604	05:19:05
#22	Add	Search diagnostic radiology	889755	05:18:21
#21	Add	Search oral radiology	5781	05:17:56
#20	Add	Search dental radiology	26369	05:17:23
#19	Add	Search histopathologic	37286	05:17:02
#18	Add	Search diagnostic histopathology	6243	05:16:08
#17	Add	Search histopathological diagnosis	51654	05:15:49
#16	Add	Search histopathology	2324662	05:15:34
#15	Add	Search clinical diagnostic	1508370	05:15:09
#14	Add	Search clinical diagnosis	1611801	05:14:27
#13	Add	Search ultrasonographic evaluation	4273	05:13:28
#12	Add	Search ultrasonographic	16544	05:13:12
#11	Add	Search ultrasonography diagnosis	322484	05:12:45
#10	Add	Search ultrasonography	328057	05:12:35
#9	Add	Search ultrasound imaging	339456	05:12:14
#8	Add	Search ultrasound	396594	05:12:03
#7	Add	Search mandible	55833	05:11:30
#6	Add	Search maxilla	28913	05:11:14
#5	Add	Search malignant swellings	1890	05:10:36
#4	Add	Search benign swellings	1316	05:10:13
#3	Add	Search cystic swellings	2169	05:09:53
#2	Add	Search inflammatory swellings	14274	05:09:33
#1	Add	Search jaw swellings	506	05:08:56

Search Methodology: (MESH)

History

Clear history

Search	Add to builder	Query	Items found	Time
#67	Add	Search **((#64) AND #65) AND #66** Filters: **Humans; English**	81	23:58:52
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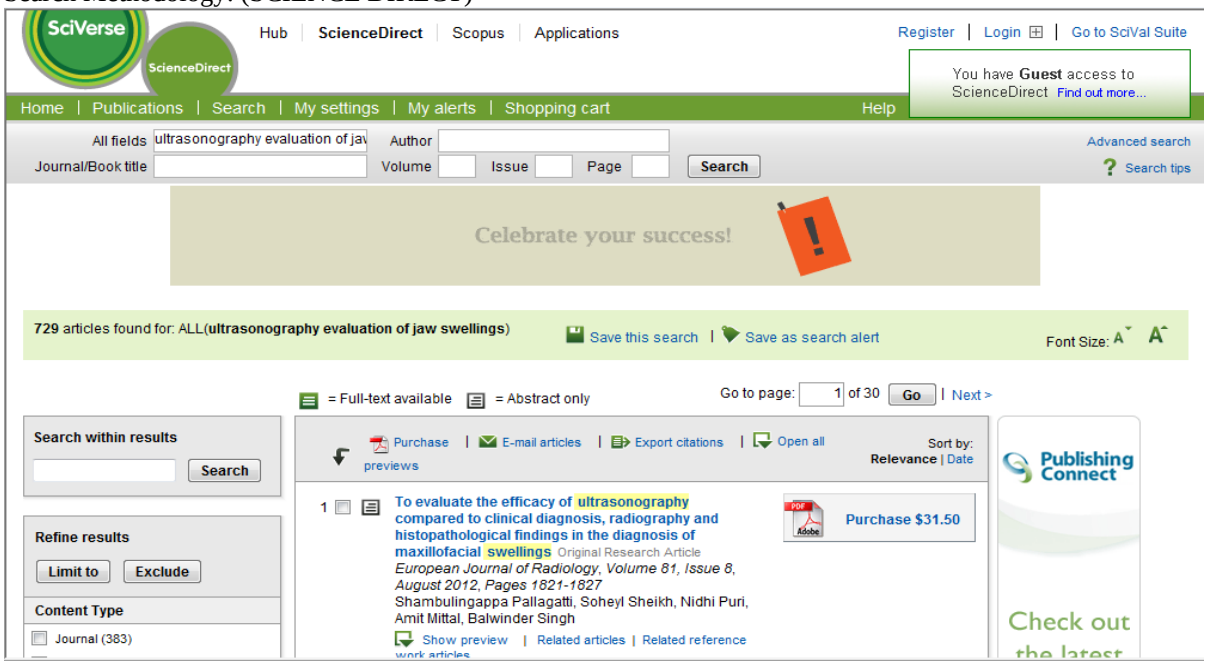
#54	Add	Search **"Jaw Cysts"[Mesh]**	6495	23:44:11
#51	Add	Search **"Jaw Neoplasms"[Mesh]**	17160	23:43:14
#44	Add	Search **"Edema"[Mesh]**	32957	23:40:43
#42	Add	Search **"Mandible"[Mesh]**	41728	23:39:57
#40	Add	Search **"Maxilla"[Mesh]**	21179	23:39:32
#36	Add	Search **"Jaw"[Mesh]**	79468	23:38:48
#31	Add	Search **"Head"[Mesh]**	147842	23:37:41
#27	Add	Search **"Ultrasonography, Doppler, Color"[Mesh]**	14698	23:36:42
#19	Add	Search **"Ultrasonography, Doppler, Duplex"[Mesh]**	19009	23:35:54
#13	Add	Search **"Ultrasonography, Doppler"[Mesh]**	51220	23:31:55
#15	Add	Search **"Ultrasonography"[Mesh]**	228562	23:27:37

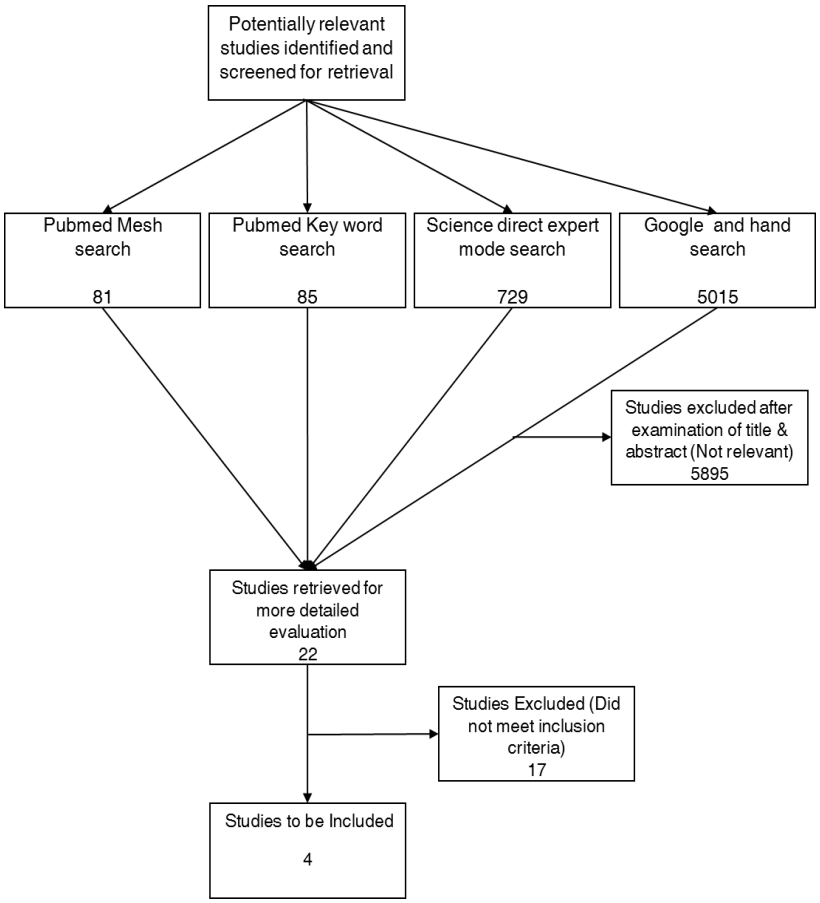
Search Methodology: (SCIENCE DIRECT)



Criteria for considering studies for this review
We included studies in which diagnosis are made underultrasonography in jaw swellings. The main inclusion entering being Clinical

Criteria for included studies for this review
Clinical trial
Any age groups
Jaw swellings maxilla and mandible
The articles are excluded according to following criteria
Case reports and review articles
Neck swellings

Search flow chart



VARIABLES OF INTEREST TABLE

ACCURACY OF USG EVALUATED	SHAPE	Oval, round, lobular, polygonal, irregular,
	BOUNDARY	Very clear, relatively clear, partialy unclear, ill defined
	ECHO INTENSITY	Anechoic, isoechoic, hypoechoic, hyperechoic, mixed
	USG ARCHITECHTURE	Homogenous, heterogenous
	NECROSIS	Ecentric, central
	CALCIFICATION	Macrocalcification, microcalcification
	POSTERIOR ECHOES	Enhanced, unchanged, attenuated,
	CHARACTERISTICS	Cystic, solid, mixed
SENSITIVITY		
SPECIFICITY		
POSITIVE PREDICTION		
NEGATIVE PREDICTION		

Data Extraction Form
A Standardized data extraction form was used to retrieve the data from the selected articles.
Citation Of Author

Name Of The Author
Year Of Publication
Sample size
Type of lesion -Inflammatory, cystic, benign and malignant swellings
Echo intensity hyperechoic, hypoechoic and anechoic
Shape
Boundary
USG Architecture
Necrosis
Calcification
Posterior echoes
Characteristics

III. Results

General Information of Study Characteristics

S.NO	AUTHOR	YEAR	TYPE OF LESION	SAMPLE SIZE	ACCURACY OF USG EVALUATED (M / NM)								USG COMPARED with
					S	B	E	A	N	C	P	C	
I.	R.Chandak	2011	INFLAMMATORY CYSTIC BENIGN MALIGNANT	70	M	M	M	M	M	M	M	M	CD
II	shivanand	2010	INFLAMMATORY CYSTIC BENIGN MALIGNANT	40	NM	NM	M	NM	NM	NM	NM	NM	CD/HIS
III	K. Srinivas	2009	INFLAMMATORY	25	M	M	M	NM	NM	NM	NM	NM	CD
IV	B.OAkinbami	2006	CYSTIC BENIGN MALIGNANT	76	M	M	M	M	M	M	M	M	HIS

S=Shape
B=Boundary
E=Echo Intensity
A=Architecture
N=Necrosis
C=Calcification
P=Posterior Echoes
C=Characteristic

M= Mentioned
NM=Not Mentioned

CD=Clinical Dignosis
HIS=Histopathology

GENERAL INFORMATION OF STUDY RESULTS

AUTHOR		ECHO INTENSITY %				ACCURACY %				SENSITIVITY %				SPECIFICITY %			
		I	C	B	M	I	C	B	M	I	C	B	M	I	C	B	M
R.CHANDAK	A	31.4	87.5	22.2													
	I	17.1				98.5	98.5	98.5	98.5	97.1	100	100	100	100	98.3	98.3	98.0
	HO	42.8	12.5	33.3	22.2												
	H			33.3	77												
	M	8.5		11.1	55.7												
SHIVANAND																	
R.SRINIVAS										96				100			
AKINBAMI										87.5	100	80	80				

I = Inflommatory
C = Cystic
B = Beningn
M = Malignant

A = Anechoic
I = Isoechoic
HO = Hypoechoic
H = Hyperechoic
M = Mixed

EVIDENCE LEVEL OF SELECTED ARTICLE TABLE

S. No	Author and year	Article	Evidence level
1	R Chandak*,1 et al 2011	An evaluation of efficacy of ultrasonography in the diagnosis of head and neck swellings	4
2	Shivanand B BAgewadi et al 2010	Ultrasonography os swelling in orofacial region	4
3	K Srinivaset . a 2009l	Ultrasonographic evaluation of inflammatory swelling of buccal space	4
4	B.O.Akinbami et al 2006	Application of ultrasonography in the diagnosis of soft tissue swelling of cervicofacial region	4

Summation of Tables

Sensitivity

TYPE OF LESION	R.Chandak %	K.Srinivas %	B.OAkinbami
INFLAMMATORY	97.1	96	87.5
CYSTIC	100	-	100
BENIGN	100	-	80
MALIGNANT	100	-	50

Specificity

TYPE OF LESION	R.CHANDAK %	K.SRNIVAS %	B.O AKINBAMI %
INFLAMMATORY	100	100	-
CYSTIC	98.3	-	-
BENIGN	98.3	-	-
MALIGNANT	98.4	-	-

POSITIVE PREDICTION

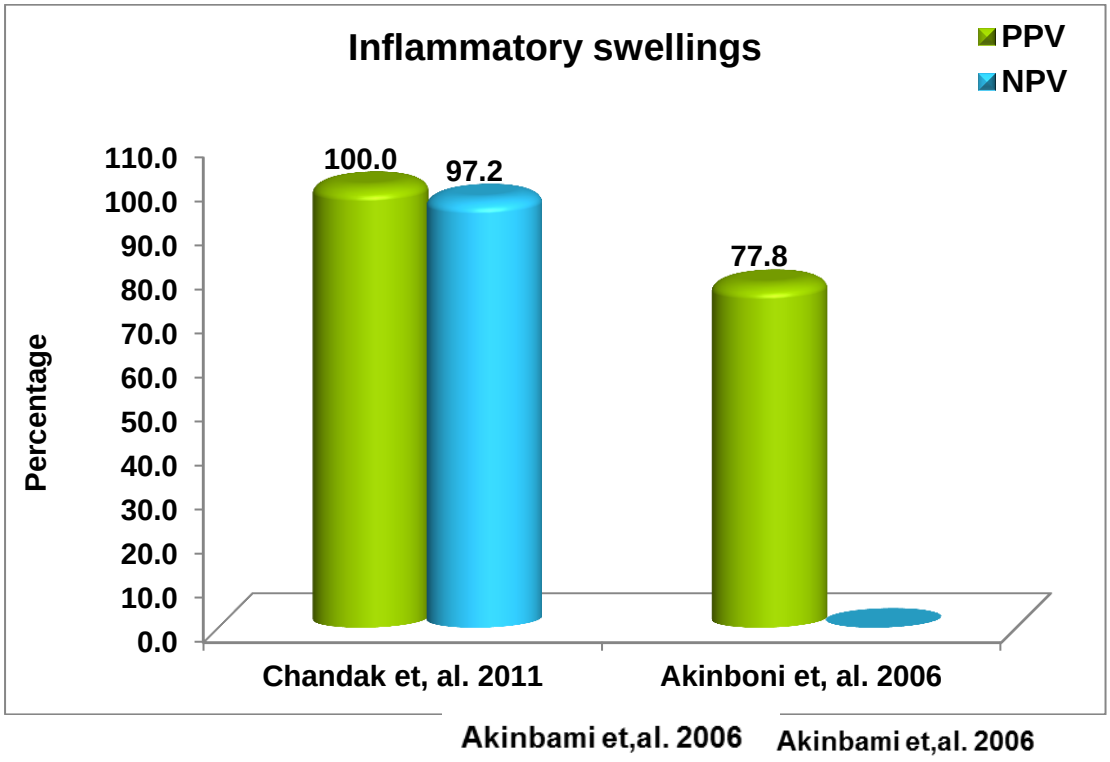
TYPE OF LESION	R.CHANDAK %	K.SRINIVAS %	B.O AKINBAMI %
INFLAMMATORY	100	-	77.8
CYSTIC	88.8	-	100
BENIGN	90.2	-	80
MALIGNANT	94.7	-	50

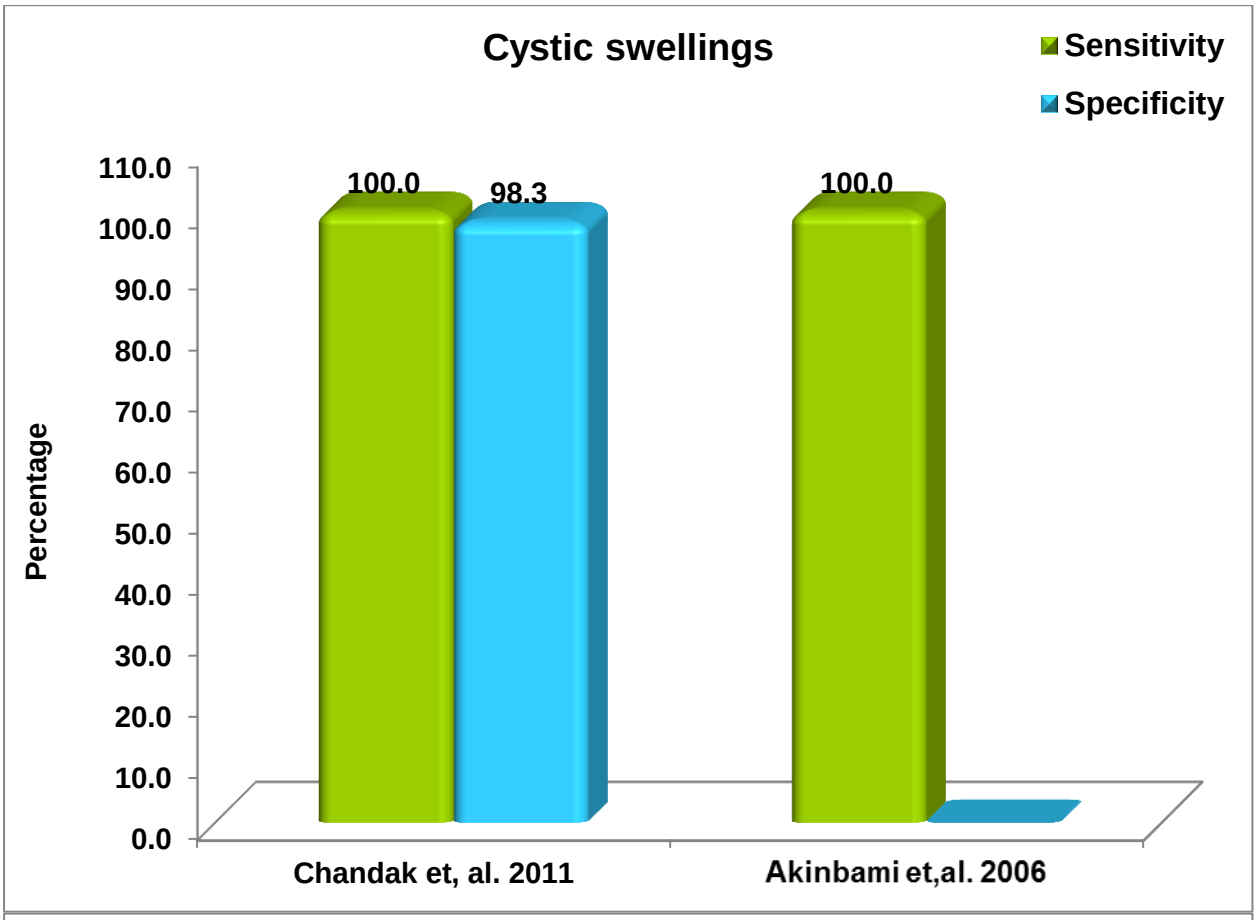
NEGATIVE PREDICTION

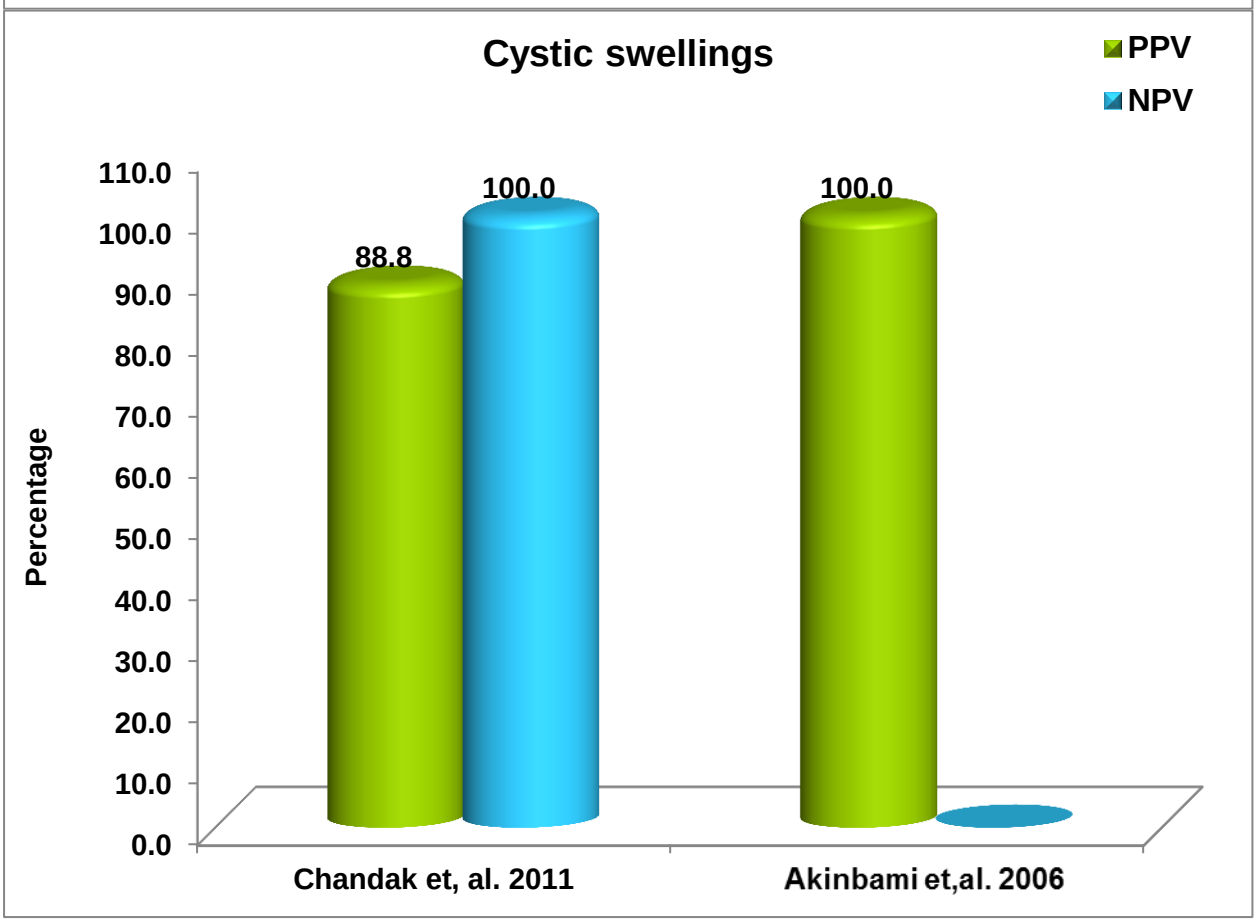
TYPE OF LESION	R.CHANDAK %	K.SRINIVAS %	B.O AKINBAMI %
INFLAMMATORY	97.2	-	-
CYSTIC	100	-	-
BENIGN	100	-	-
MALIGNANT	100	-	-

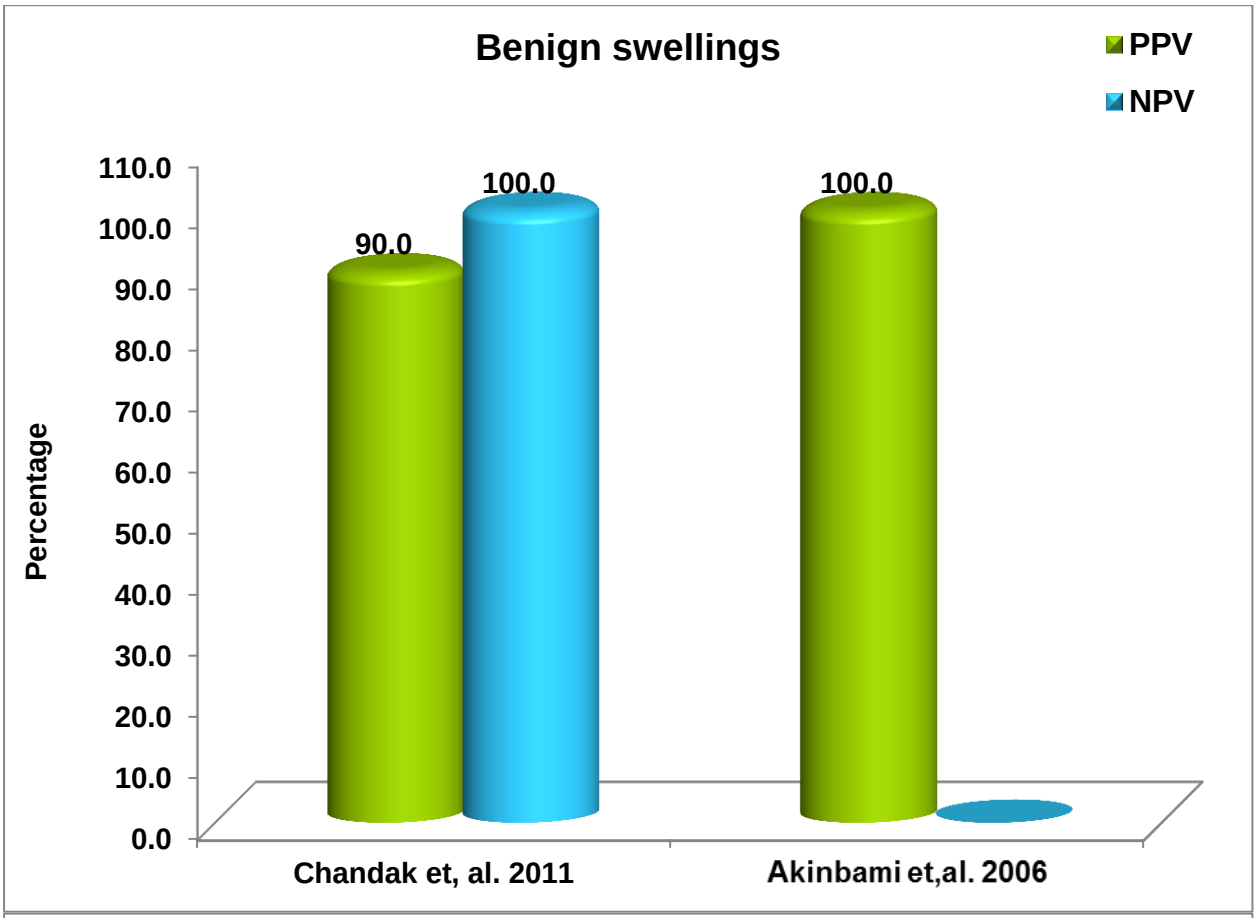
ACCURACY

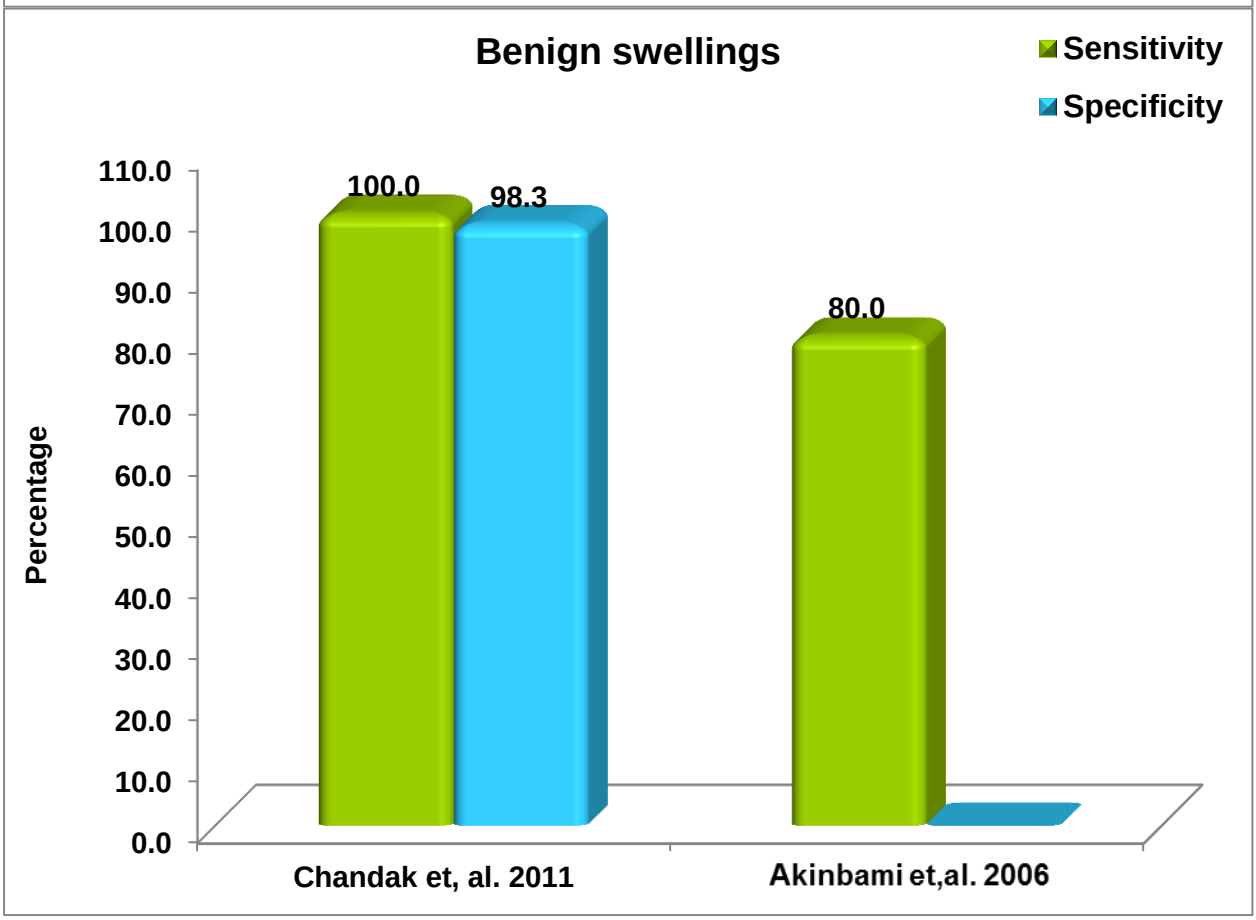
TYPE OF LESION	R.CHANDAK %	K.SRINIVAS %	B.O AKINBAMI %
INFLAMMATORY	98.5	-	70
CYSTIC	98.5	-	100
BENIGN	98.5	-	100
MALIGNANT	98.5	-	100

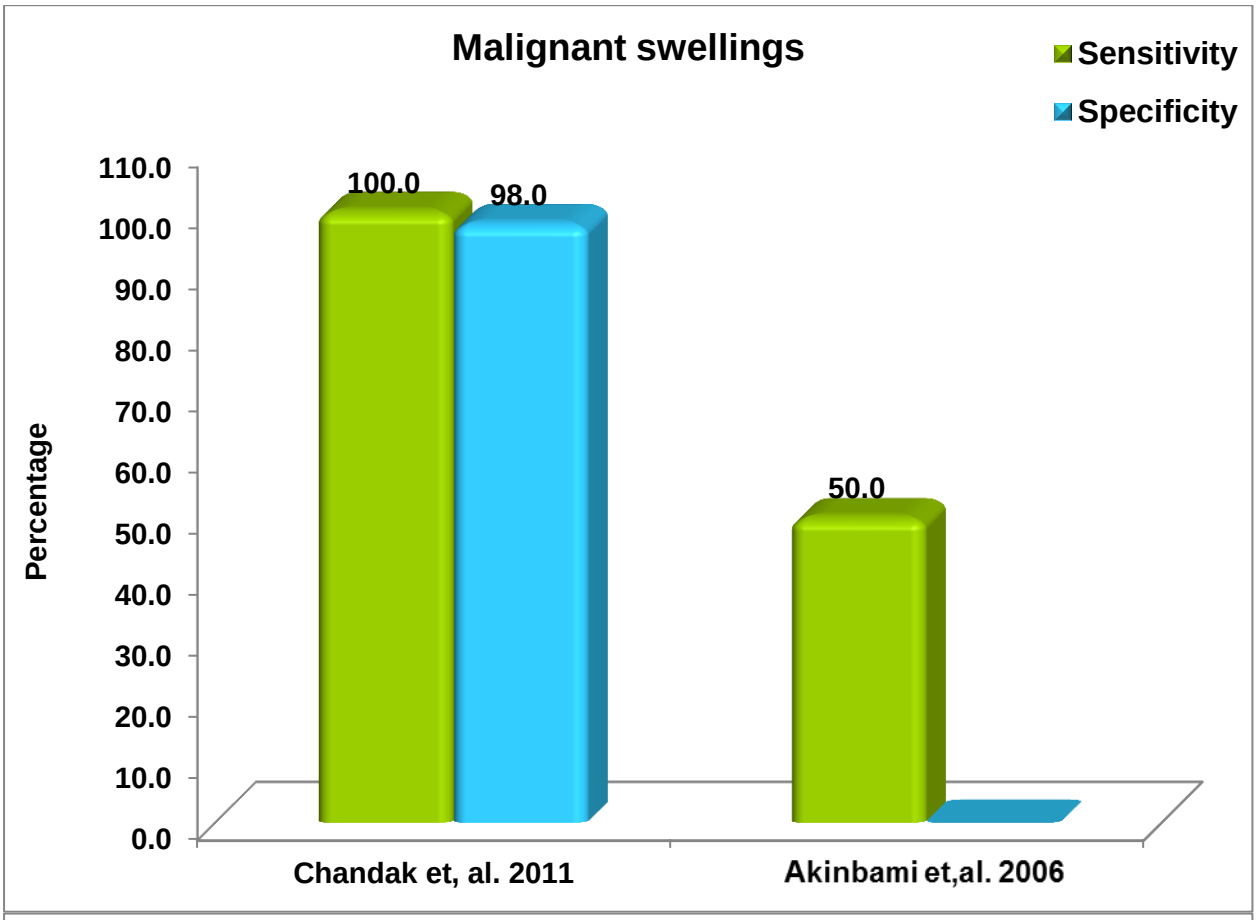


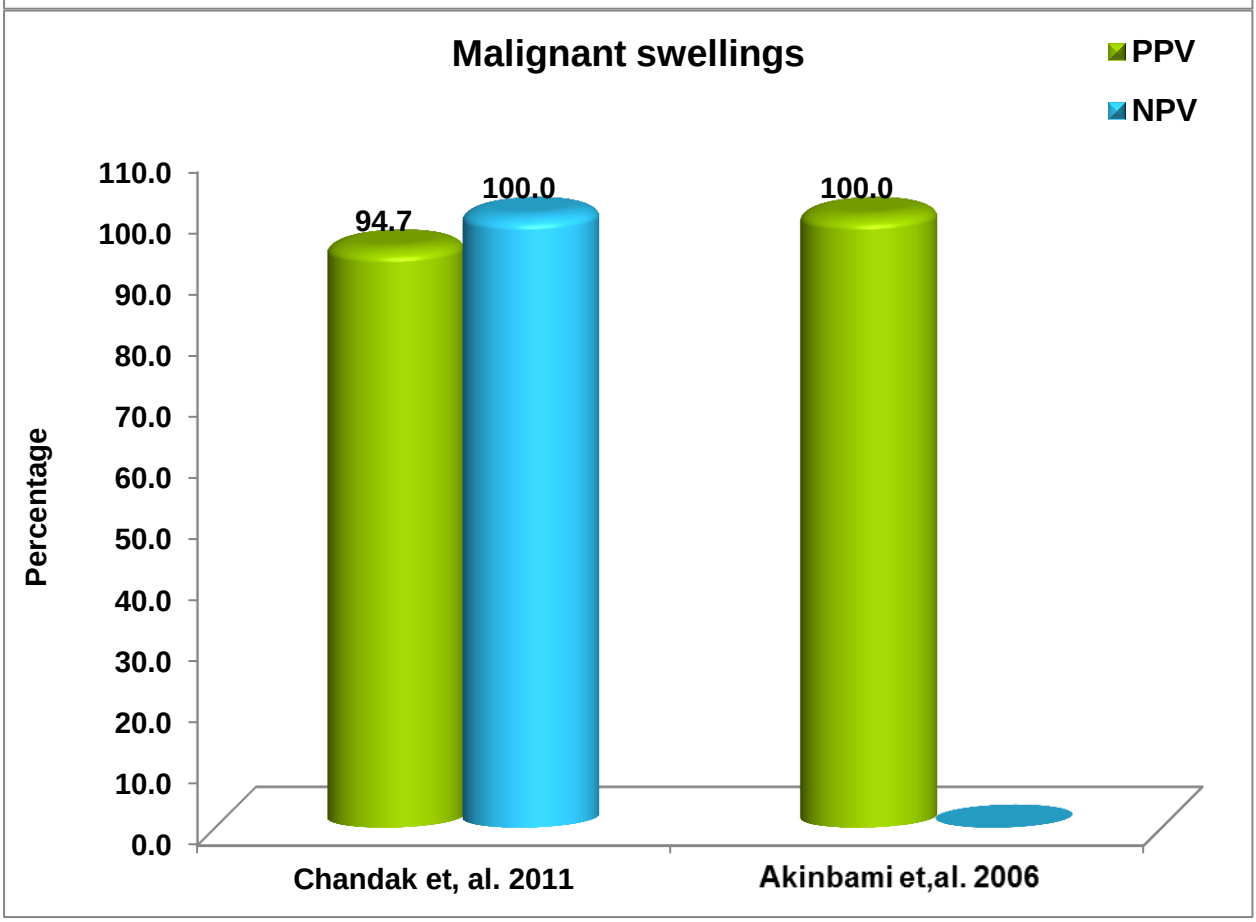

Cystic swellings
Sensitivity
Specificity
Percentage
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
98.3
100.0
Chandak et, al. 2011
Akinbami et,al. 2006


Cystic swellings
PPV
NPV
Percentage
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
88.8
100.0
100.0
Chandak et, al. 2011
Akinbami et,al. 2006


Benign swellings
PPV
NPV
Percentage
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
90.0
100.0
100.0
Chandak et, al. 2011
Akinbami et,al. 2006


Benign swellings
Sensitivity
Specificity
Percentage
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
98.3
80.0
Chandak et, al. 2011
Akinbami et,al. 2006


Malignant swellings
Sensitivity
Specificity
Percentage
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
98.0
50.0
Chandak et, al. 2011
Akinbami et,al. 2006


Malignant swellings
PPV
NPV
Percentage
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
94.7
100.0
100.0
Chandak et, al. 2011
Akinbami et,al. 2006

IV. Discussion

Accurate Reporting and Interpretation of Result

In R.Chandakstudy, most of the inflammatory swellings hadrelatively clear boundaries, irregular shapes, hypoechoicecho intensity and homogeneous ultrasound architectureof lesion.hypoechoic areas and heterogeneous echo texture of thegland as seen in inflammatory swellings in the group of inflammatory swellings,clinical diagnosis had a sensitivity and specificity of85.7% whereas sonographic diagnosis had a sensitivityof 97.1% and specificity of 100% Cysts on the sonogram appear as anechoic with avery clear boundary and homogeneous echo texture.If the cysts become infected then the content of thelesion can produce some echoes, producing hypoechoicstructures.All cystic lesions showed very clear boundaries,were suggestive of periapical cyst.

In the group of cystic swellings, clinicaldiagnosis had a sensitivity of 75% and a specificity of 87.1%, whereas sonographic diagnosis had a sensitivityof 100% and a specificity 98.3%.Clinical diagnosis of benign neoplasmshad a sensitivity of 77.7% and specificity of 86.8%,whereas sonographic diagnosis had a sensitivity of100% and a specificity 98.3%, and the accuracy of thetest was 98.5% Ultrasound can predict malignancy in 89%of cases butvarious forms of malignancy cannot be differentiated. Onultrasounds of lower grade tumours, smaller lesions mayappear as well defined and similar to a benign tumour.malignantneoplasms, clinical diagnosis had a sensitivity of 94.4%and specificity of 82.6%, whereas sonographic diagnosishad a sensitivity of 100.0% and specificity of98.0%.

InShivanand B. Bagawadiet al ultrasonography diagnosis inflammatory swellings was anechoic /hypoechoic pattern with clinical diagnosis100% and ultrasonographic diagnosis of 100%,cystic swellings was anechoic pattern with clinical diagnosis of 96.6% and USG of 100%,benign swellings shows hypoechoic pattern with clinical diagnosis of 1oo% and USG of 100%,malignant swellings was hypo/hyperechoic pattern with clinical diagnosis of 100% and USG of 100%.

According to R.Srinivaset al inflammatory swellings of buccal space in USG shows hypoechoic in 54.2% and anechoic in 45.8%,Clinical diagnosis was92% and USG was 96% and sensitivity of clinical criteria over ultrasonographic diagnosis was 96% with a specificity of 100%.

In B.O Akinbamiet al inflammatory swellings shows accuracy 70%,sensitivity 87.5%,specificity 0.0% positive prediction was 77.8%and negative prediction was 0.0%.

In cystic swellings the accuracy is 100%,sensitivity 100%,specificity 0.0%,positive prediction 100%, negative prediction 0.0%

In benign swellings accuracy is 80%,sensitivity 80%,specificity 0.0% positive prediction 100% and negative prediction is 0.0%

In malignant swellings the accuracy is50%,sensitivity50%,specificity 0.0% positive prediction 100% and negative prediction was 0.0%.

Quality assurance TABLE STARD Statement

Standards for the Reporting of Diagnostic accuracy studies

Check List	R.Chandak	Shivanand	K.Srinivas	BO Akinmami
Inclusion, exclusion criteria	Mentioned	Mentioned	Mentioned	Mentioned
Compared with gold standard	No	Yes	No	Yes
Described about data collection	No	No	No	No
Described reference standard and rationale	No	Yes	No	Yes
Units rationale	Mentioned	Mentioned	Mentioned	Mentioned
Training and expert of person	Mentioned	not mentioned	Not mentioned	Mentioned
Blinding	Mentioned	No	No	No
Satistical methods CI%	No	No	No	No
Results –Test Reproducibility	Mentioned	Not mentioned	Not mentioned	Not mentioned
Flow chart for clinical criteria	No	No	No	No

Treatment done in time and interval of and reference std	No	No	No	No
Participants target condition	Mentioned	Mentioned	Mentioned	Mentioned
Tabulation of results	Mentioned	Mentioned	Mentioned	Mentioned
Outlier data	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Clinical applicability of study	Mentioned	Mentioned	Mentioned	Mentioned

V. Conclusion

Ultrasonography can be used as a diagnostic aid in jaw swellings.But Quality studies which assesing the diagnostic accuracy, sensitivity and specificity are less.Among three studies, all studies gives high sensitivity, specificity for inflammatory and cystic swellings. Whereas sensitivity and specificity in assesing for benign and malignant lesions, the studies shows highly variable results.To conclude, quality studies are needed to establish whether the ultrasonography diagnosis is accurate in all jaw swellings.

References

INCLUDED STUDIES

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