

WEST MIDLANDS
OBSTETRIC ULTRASOUND
BIOMETRY AUDIT

March 2003

SUMMARY OF STANDARDS AUDIT

BACKGROUND

The Regional Ultrasound Group formed a subgroup to look at ultrasound standards. The members of the subgroup were David Cole, Jo McHugo, Ellen Poole, Marguerite Usher-Somers, and Mike Wyldes. This subgroup was charged with examining measurable standards and methods for assessment. Any method used must be simple, be an opt-in, clinically driven initiative, and not impose additional work on departments that are already stretched.

Nick Dudley was invited to a meeting of the subgroup to present the method he developed and published for auditing ultrasound standards in Trent. It was based on routine print outs of thermal scan images. These were collected and classified as ideal, adequate or un-measurable. It was agreed that this would be used as a model for a region-wide audit of ultrasound measurement for the West Midlands. Those participating would receive feedback on their results compared to the regional baseline.

All Ultrasound Departments within West Midlands Maternity Units were contacted and 18 units agreed to take part.

METHODS

1. On the audit day all scans performed that day, all people scanning, including those outside the department, were included.
2. A data sheet was produced for each unit to collect the volume of work and number of people scanning on that day, machines, staffing etc.
3. Thermal images of all measurements were taken (or the best image obtained if unable to measure).
4. A sticker was produced by WMPI, which included some brief details including gestation, initials or code-number for the sonographer - (optional if departments do not wish information on individuals) and an assessment of each image made by the operator.

Methods - Strengths

Region-wide
Cross-sectional snapshot
High levels of participation
Large numbers of images
Three "assessors"
Simple data collection method

Method – Weaknesses

Not all sonographers/sonologists involved as just 1 day
May not include "isolated" sites in community settings
1 day will not be a representative sample for individuals
Differences in workload on different days of the week
Thermal image quality may not reflect screen image
Analysis method complex
Repeating assessments took time
Variation between assessors shows differences of opinion
Delay between data collection and feedback
Self-assessment of "image quality" may not compare directly with structured assessment by assessors
Feedback through departments may not lead to any changes
IF too critical may be counterproductive

IF too self-congratulatory may be counterproductive
 May be too “remote” from users

PARTICIPANTS

Participating units

Alexandra	Queen's, Burton
B'ham Heartlands	Royal Shrewsbury
B'ham Women's	Sandwell
City	Solihull
George Eliot	Walsall Manor
Hereford County	Walsgrave
Kidderminster	Warwick
New Cross	Worcester Royal
North Staffordshire	Wordsley

Eighteen maternity units took part; two units did not take part. This represents 92% of the total number of deliveries in the region.

Table 1 - Unit activity, number of scans by trimester

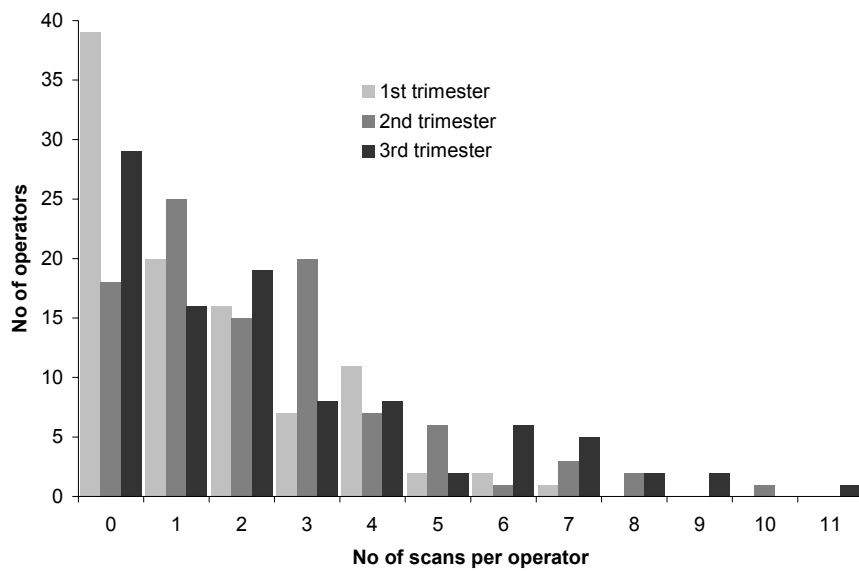
Unit code	1st trimester		2nd trimester		3rd trimester		Total scans
	n	%	n	%	n	%	
02	1	9%	8	73%	2	18%	11
03	13	36%	11	31%	12	33%	36
04	11	38%	9	31%	9	31%	29
05	11	28%	14	35%	15	38%	40
06	1	5%	13	65%	6	30%	20
07	7	19%	10	28%	19	53%	36
08	9	23%	19	48%	12	30%	40
09	16	19%	40	47%	30	35%	86
10	5	24%	10	48%	6	29%	21
11	23	40%	16	28%	18	32%	57
12	5	25%	6	30%	9	45%	20
13	3	9%	8	25%	21	66%	32
14	11	24%	11	24%	24	52%	46
15	11	41%	7	26%	9	33%	27
16	0	0%	14	56%	11	44%	25
17	17	36%	20	43%	10	21%	47
18	8	18%	18	40%	19	42%	45
19	6	35%	4	24%	7	41%	17
All units	158	25%	238	37%	239	38%	635

Ninety-eight people identified themselves as undertaking obstetric ultrasound examinations (27 images were not ascribed to an operator).

Table 2 - Unit staffing, number of operators per unit

No of operators	Units
2	1
3	4
4	3
5	2
6	1
7	3
8	2
9	1
10	1
Total	18

Chart 1 - Operator activity by trimester



1,752 images were taken from 635 pregnant women.

INDICATIONS AND MEASUREMENTS

Table 3 - Indications and outcomes: first trimester scans

Indication	ongoing	misc	ectopic	other	blank	Total	%
Dating	106	1		1	11	119	75%
Bleeding/pain	23	4	1	2		30	19%
Other	5	1				6	4%
Blank	1				2	3	2%
Total	135	6	1	3	13	158	100%
% total	85%	4%	1%	2%	8%	100%	

Chart 2 - Measurements: first trimester scans

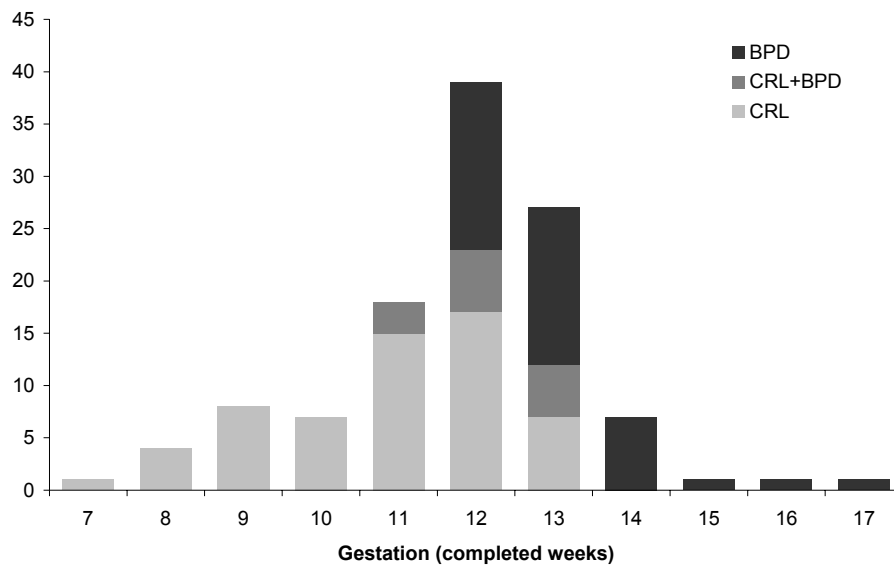


Table 4 - Indications: second trimester scans

Indication	Total	%
Routine anomaly	190	80%
Detailed	16	7%
Cx Length	1	0%
Other	17	7%
Blank	14	6%
Total	238	100%
% total	100%	

Table 5 - Indications: third trimester scans

Indication	Total	%
Obstetric risk	72	30%
SFD	32	13%
Placental site	31	13%
Other	101	42%
Blank	3	1%
Total	239	100%
% total	100%	

ASSESSMENT METHODS

Initially all images were assessed, following the presentation of preliminary results in November 2002 it was decided to exclude images that operators indicated were poor. This was approximately 10% of scans (64 scans of 167 images). In addition some scans were not assessed for various reasons, e.g. too early gestation, problems with the thermal image. In addition, the following images were not assessed:

1. Femur length
2. Crown rump length < 20 mm
3. Second trimester abdominal circumference

All remaining images were assessed independently by two of the three external assessors (David Cole, Nick Dudley, and Mike Wyldes). Following this first round of assessments if there was no agreement between assessors as to where the images should pass or fail, the images were re-assessed at a meeting of all three assessors.

The standards used in the assessment process are included in Appendix 1 - these had not been circulated to operators taking part in the study.

First trimester

Of the 163 images received, 36 images were not suitable for assessment and a further 20 were classified as poor by the operator and were therefore excluded. Therefore, 107 first trimester images were assessed.

Table 6 - External/operator assessment: first trimester scans

Operator	Assessor			
	Pass	Fail	Total	% pass
Good	36	12	48	75%
Acceptable	30	28	58	52%
Blank	1	0	1	100%
Total	67	40	107	63%

The most common causes of failure were:

- Magnification - measurement (CRL or BPD) should occupy at least one third of the screen.
- Landmarks - Standard landmarks
- Angle - e.g. For BPD should be perpendicular (15 degree tolerance)

Second Trimester

Of the 238 images received, 13 images were not suitable for assessment and a further 24 were classified as poor by the operator. Therefore, 201 second trimester images were assessed.

Table 7 - External/operator assessment: second trimester scans

Operator	Assessor			
	Pass	Fail	Total	% pass
Good	76	26	102	75%
Acceptable	69	28	97	71%
Blank	2	0	2	100%
Total	147	54	201	73%

The most common causes of failure were:

- Landmarks
- A-P & R-L alignment
- Magnification
- Caliper placement

Third trimester

Table 8 - External/operator assessment: third trimester scans

Operator	Assessor			
	Pass	Fail	Total	% pass
Good	117	47	164	71%
Acceptable	139	88	227	61%
Blank	5	4	9	56%
Total	261	139	400	65%

Of the 437 images received, 34 images were not suitable for assessment and a further 3 were classified as poor by the operator. Therefore, 400 third trimester images were assessed.

The most common causes of failure were:

- A-P & R-L alignment
- Landmarks
- Caliper placement
- Magnification

Table 9 - Scan assessment, pass rate by trimester, all units

Unit	1st trimester			2nd trimester			3rd trimester			All images			
	Pass	Fail	%	Pass	Fail	%	Pass	Fail	%	Pass	Fail	%	Total
02	0	0		7	1	88%	3	1	75%	10	2	83%	12
03	5	4	56%	8	3	73%	16	5	76%	29	12	71%	41
04	7	1	88%	6	0	100%	5	10	33%	18	11	62%	29
05	4	6	40%	8	3	73%	14	11	56%	26	20	57%	46
06	0	0		9	4	69%	5	3	63%	14	7	67%	21
07	4	1	80%	7	3	70%	28	7	80%	39	11	78%	50
08	1	3	25%	13	5	72%	12	12	50%	26	20	57%	46
09	11	2	85%	25	5	83%	30	12	71%	66	19	78%	85
10	0	0		5	0	100%	8	2	80%	13	2	87%	15
11	7	9	44%	13	2	87%	22	10	69%	42	21	67%	63
12	1	0	100%	3	1	75%	8	6	57%	12	7	63%	19
13	0	0		5	3	63%	18	15	55%	23	18	56%	41
14	3	3	50%	2	8	20%	22	14	61%	27	25	52%	52
15	5	5	50%	4	2	67%	14	2	88%	23	9	72%	32
16	0	0		11	2	85%	18	4	82%	29	6	83%	35
17	13	2	87%	12	4	75%	16	2	89%	41	8	84%	49
18	3	4	43%	7	7	50%	18	16	53%	28	27	51%	55
19	3	0	100%	2	1	67%	4	7	36%	9	8	53%	17
WM total	67	40	63%	147	54	73%	261	139	65%	475	233	67%	708

CONCLUSIONS

Quality assurance in ultrasound is difficult

Even with a structured method, there is a subjective assessment

This method does not compare like with like

Inter-observer variability is around 20% between assessors

Conclusions vary between trimesters

- First trimester – magnification
- Second trimester – landmarks
- Third trimester – landmarks & alignment (AC)

Most difficult measurement is AC, which is probably the most important in the third trimester as it is most predictive of fetal weight.

Appendix 1

STANDARDS FOR FETAL MEASUREMENT AUDIT

CRL

Angle:	Within 30° of horizontal (to allow proper visualisation of structures).
Landmarks:	Head and full length of trunk.
Alignment:	Trunk not foreshortened.
Callipers:	Top and tail.
Magnification:	Target >50% of image taken up by measured structure, pass criterion if >30%.

HEAD MEASUREMENTS

Angle:	Angle between BPD and ultrasound beam axis less than 30°.
Landmarks:	Standard landmarks visible, i.e. cavum, thalami, midline.
R-L alignment:	Symmetrical about midline.
A-P alignment:	Landmarks correctly positioned, other features outside measurement plane not seen, e.g. orbits, cerebellum; rugby ball shape.
Calliper placement:	For BPD outer to inner at 90° to midline; for HC follows skull outline.
Magnification:	Target >50% of image taken up by measured structure, pass criterion if >30%.

FEMUR LENGTH

Just record measurement on same sticker as BPD assessment.

ABDOMEN

Angle:	A-P axis more than 30° from beam axis.
Landmarks:	Standard landmarks visible, i.e. short section of UV 1/3 in from anterior wall, lower pole of stomach, circular cross-section of spine.
R-L alignment:	Symmetry about A-P axis, symmetry of ribs (accounting for differing reflections due to convex arrays), small stomach.
A-P alignment:	Short UV, circular cross-section (allowing for effect of pressure in the third trimester, which may distort shape).
Calliper placement:	Follows abdominal skin outline.
Magnification:	Target >50% of image taken up by measured structure, pass criterion if >30%.

GENERAL

For small departures from quality criteria, pass if unlikely to affect size of measurement, e.g. BPD measurement slightly off 90° to midline.