

Are the two fundus images enough for screening?

- ▶ INDU KUMAR
- ▶ CLINICAL LEAD
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- ▶ BARS CONFERENCE
- ▶ 26TH SEPTEMBER 2024

Diabetes

- ▶ In UK, 4.4 million people have a diagnosis of diabetes.
- ▶ This is 6% of the population
- ▶ Men account for 56%

One of the major cause of sight loss amongst registered blind and partially sighted people

- Age-related macular degeneration – 48 per cent
- Glaucoma – 16 per cent
- Cataract – 12 per cent
- Retinitis Pigmentosa – 10 per cent
- **Diabetic eye disease – 8 per cent**

Imaging in Diabetic retinopathy screening

- ▶ DR occurs in about a third of people with diabetes
- ▶ Vision threatening retinopathy in 4.4%
- ▶ Proliferative DR occurs in 3-7 % patients
- ▶ 18% patients get PDR after 15 yrs of Type 1 or Type 2 Diabetes and 50% after 20 yrs of Type 1
- ▶ Varies with ethnicity and control of risk factors and diabetic screening programmes

Diabetic Eye screening in UK

- ▶ Screening programmes using digital retinal photography commenced in 1998
- ▶ National programme was established in 2004

Adequate imaging in diabetic screening

Two 45 degrees images centred on fovea (macular image) and disc per eye.

- ▶ Macular image : The centre of fovea is 2 DD from edge of image and 3rd generation vessels are visible within the macula
- ▶ Disc image : the complete optic disc is 2DD from edge of image and fine vessels are visible on the surface of the disc

Case

64 year - old man

Type 2 DM HbA1c 68

Refd urgently from DESP

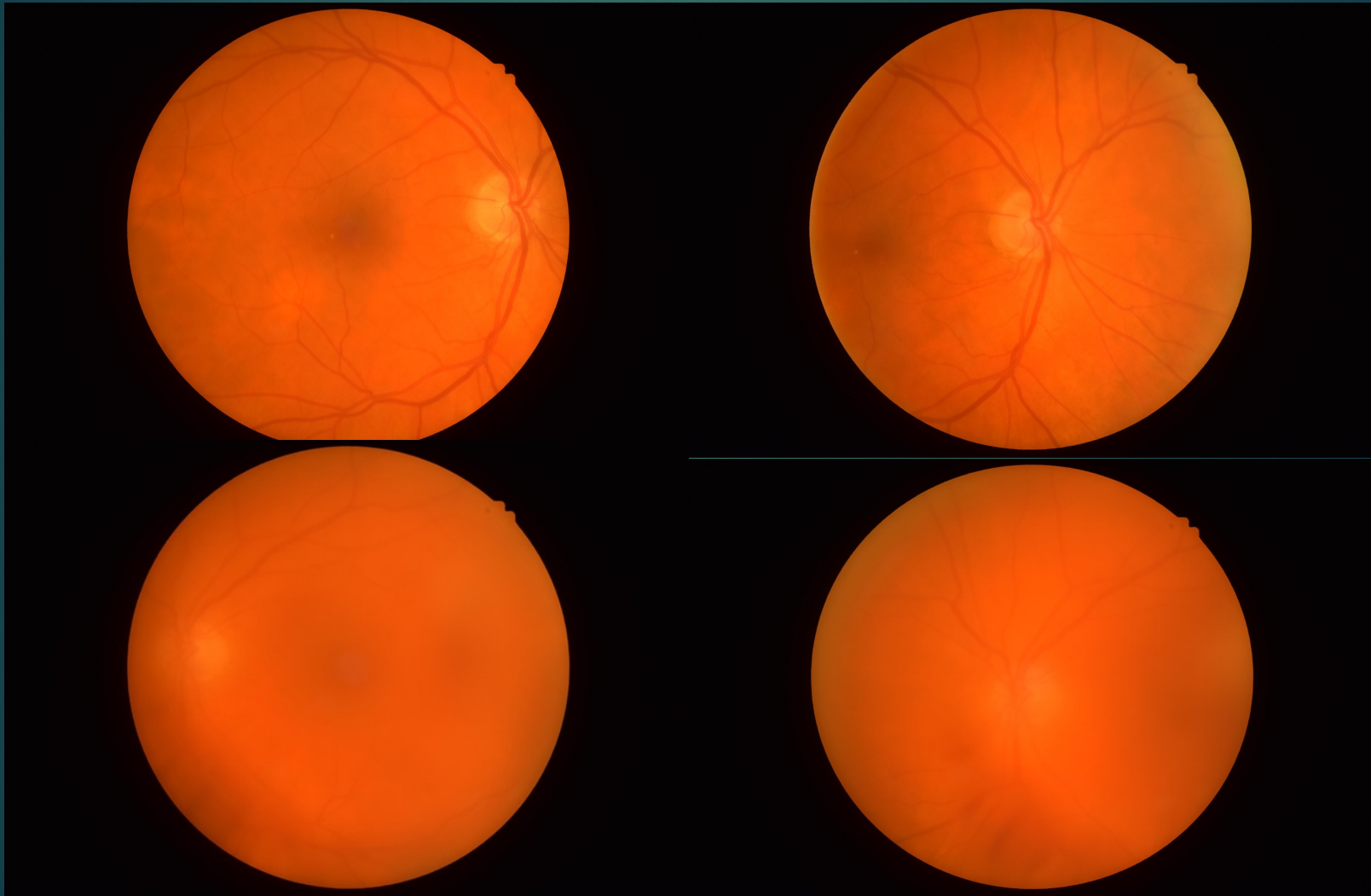
With VA Right eye 6/9 and Left eye 6/60

RE R1M0

LE R3A MU

Right eye R1M0

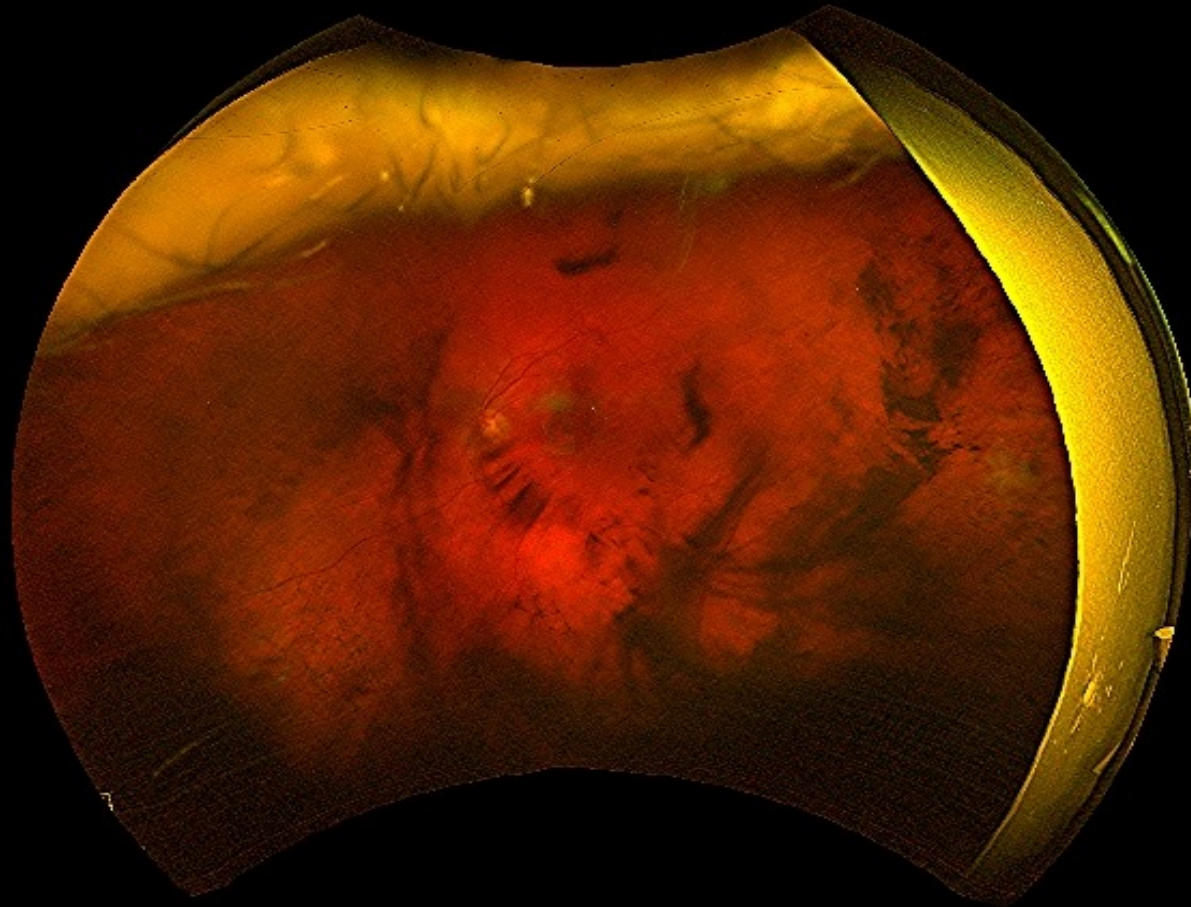
Left eye R3A MU



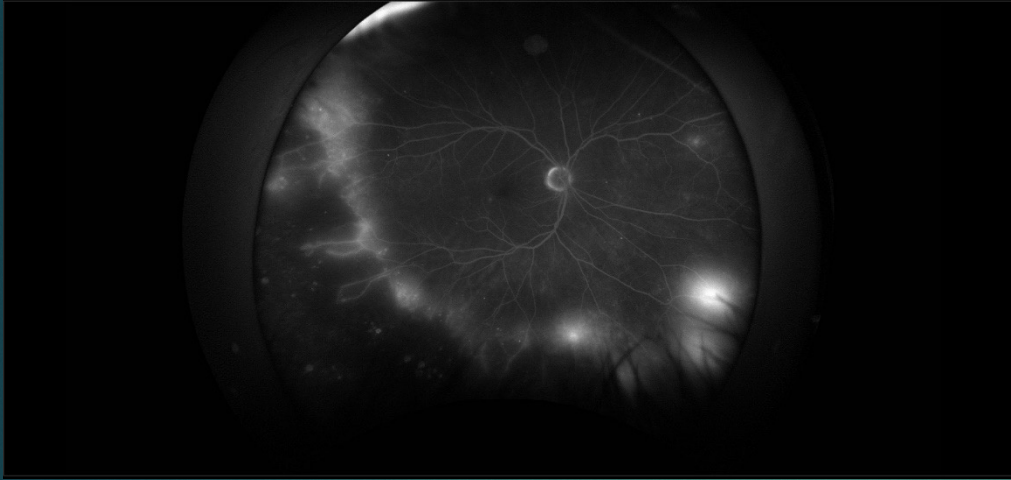
Refd as R1M0

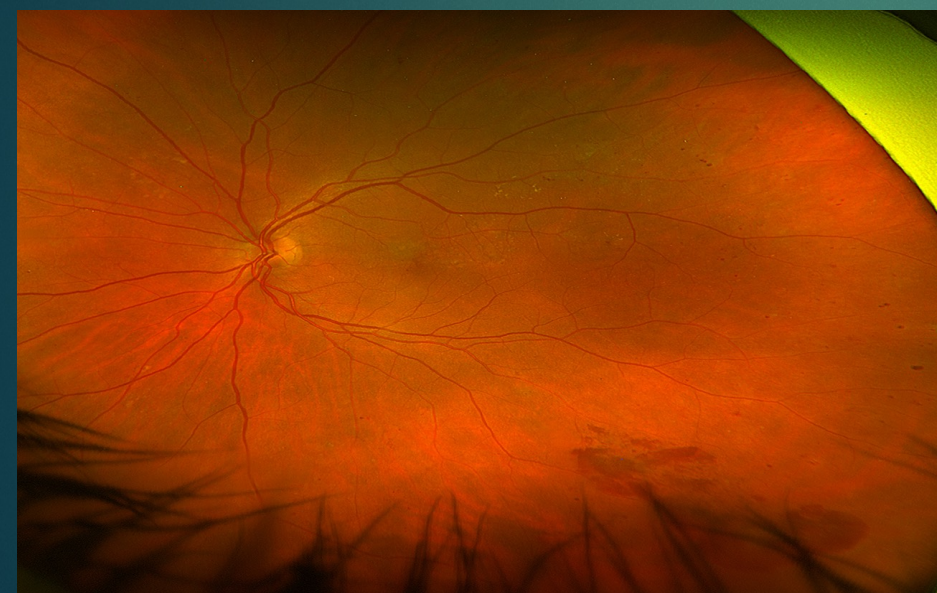


R3aMU



PDR with NVE outside the area of the two images





New vessels detected by wide field

Patients referred from DRSS with
pre-proliferative R2
proliferative DR R3
diabetic maculopathy, M1
Examined by optos

Total of 102 eyes out of 1562 (6.5%) were found to have NV on optos
Out of these , 72 (71%) were referred as R3

30 eyes of 102 PDR eyes were missed on two images (29 % of all R3s and about 2 % of all refd eyes)

12 eyes with R3 were missed on seven field (12% of all R3 and about 0.8% of all refd eyes)

Talks SJ, Manjunath V et al. New vessels detected on wide-field imaging compared to two-field and seven-field imaging: implications for diabetic retinopathy screening image analysis. *BJO* 2015;99:1606-1609

Questions

- ▶ How many photographs
- ▶ Mydriatic or non- mydriatic
- ▶ Mono or stereophotography
- ▶ Montage or wide field
- ▶ OCT

- ▶ Sensitivity and specificity
- ▶ Ungradable images
- ▶ Training needs for screeners and graders
- ▶ Resources and cost effectiveness
- ▶ Ease of patients

The English National Screening Programme for diabetic retinopathy 2003–2016

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Clinical science



New vessels detected on wide-field imaging compared to two-field and seven-field imaging: implications for diabetic retinopathy screening image analysis

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Advances in Retinal Imaging and Applications in Diabetic Retinopathy Screening: A Review

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Different fields photography

Figure 1 - One field - foveal centred

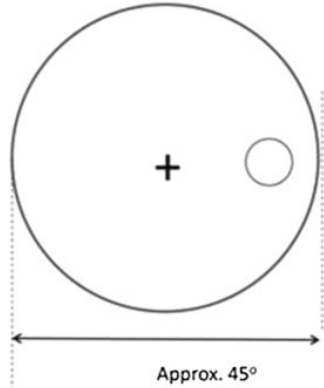
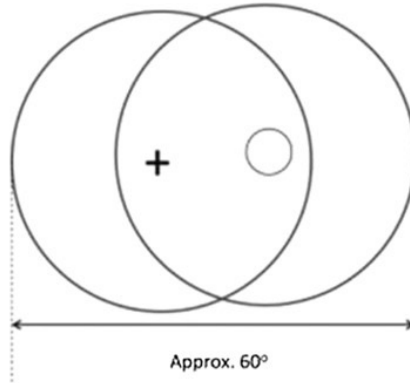
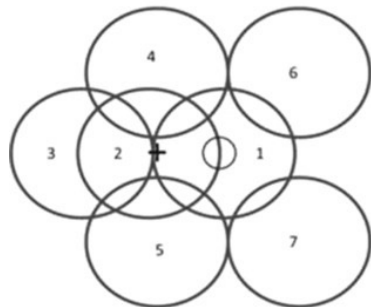


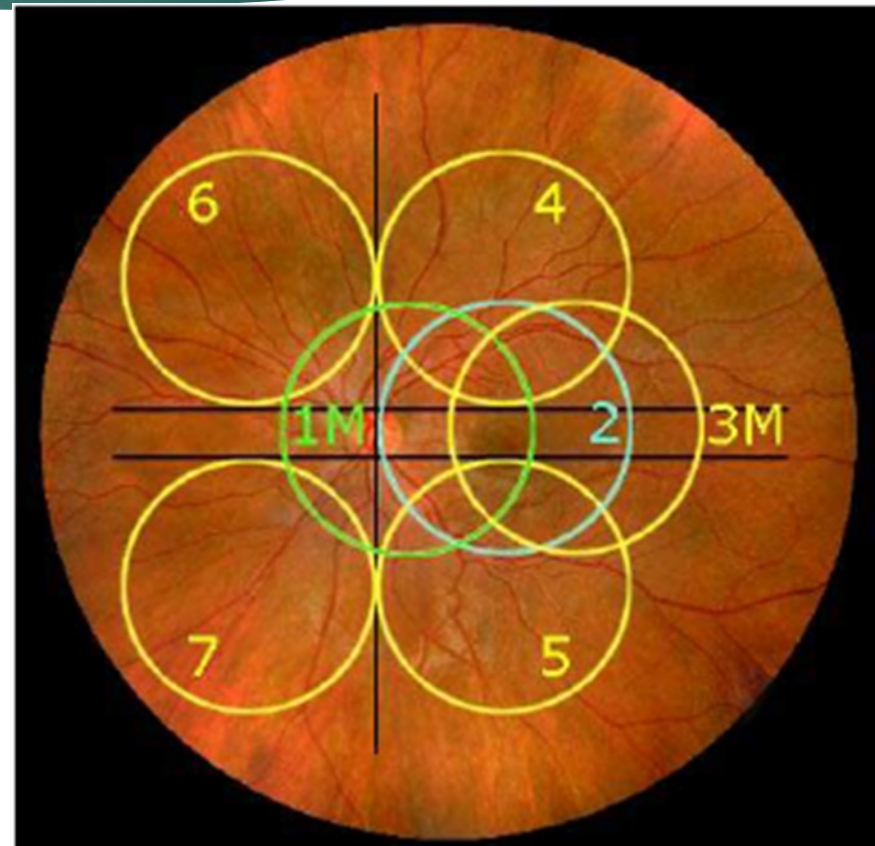
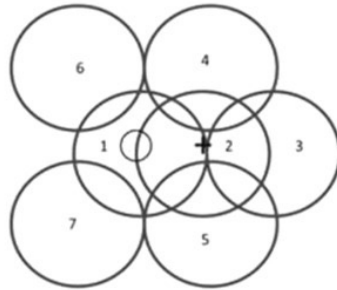
Figure 2 - 2 x 45° fields



Rt 7-field stereo



Lt 7-field stereo



	One 45° image	Two 45° Images	7 Field	Wide field
Area covered in degrees	45	60	75	200
Percentage of retina			30%	80%

Validation of the current two-field photography

With reference as the standard examination by an experienced ophthalmologist

One-field non-mydratic photography

Sensitivity 86.0% (95% CI, 80.9–91.1%)

Specificity was 76.7% (95% CI, 74.5–78.9%)

poor-quality image rate was 19.7% (95% CI, 18.4–21.0%).

Two-field mydratic photography

Sensitivity 87.8% (95% CI, 83.0–92.6%)

Specificity was 86.1% (95% CI, 84.2–87.8%)

poor-quality image rate was 3.7% (95% CI, 3.1–4.3%).

Scanlon PH, Malhotra R, et al. Comparison of two reference standards in validating two field mydratic digital photography as a method of screening for diabetic retinopathy. *Br J Ophthalmol.* 2003;87:1258–1263. doi: 10.1136/bjo

Comparison of 2 field versus 7 field stereo

Two-field mydriatic digital photography in comparison with seven-field stereo-photography.

sensitivity of 80.2% (75.2–85.2)

specificity of 96.2% (93.2–99.2)

15.3% of seven-field sets were ungradable compared with 1.5% of the two-field digital photographs.

This satisfied the consensus opinion that the screening test should be at least 80% sensitive and 95% specific

What next

- ▶ Not surprising that wider field will detect more eyes with DR
- ▶ Seven field imaging can be time consuming and demanding for the screeners and can have increased ungradeable rates
- ▶ The major constraint for wide spread adoption of ultra wide field cameras in DESP is largely financial

Maculopathy

Current criteria

- ▶ Microaneurysm / haemorrhage within 1DD of fovea with VA below 6/12

Only 17 % have retinal thickening and 6 % have macular oedema

- ▶ Circinate within 2 DD and exudate within 1DD of fovea

Only 27% had thickening on OCT

A high percentage of these patients take our slots in DS clinic and refer to HES

Also about 1/4 to 1/3 eyes with oedema on OCT are missed by fundus photographs

There is a need for OCT in screening for referral refinement

Not without challenges but in long term, it will be beneficial and cost effective

Summary and Conclusions

New imaging modalities and advances can improve diagnostic accuracy in screening services

This can help in earlier referral of sight threatening retinopathies for appropriate treatment

Also it can decrease false positive referrals for maculopathies to HES



Thank you

ANY QUESTIONS