Diabetic Retinopathy

Overview

- This presentation covers the following topics:
- Definitions
- Epidemiology of diabetic retinopathy
- Evidence for public health approaches
- Screening for diabetic retinopathy
- Health education .

Notes section – a more detailed explanation is provided in the notes along with key references.

WHO definition DM (2006)

- Chronic disease, which occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces.
- Primarily defined by the level of hyperglycaemia giving rise to risk of microvascular damage (**retinopathy**, nephropathy, and neuropathy).
- Diagnostic criteria:

  fasting plasma glucose ≥ 7.0 mmol/l (126mg/dL)

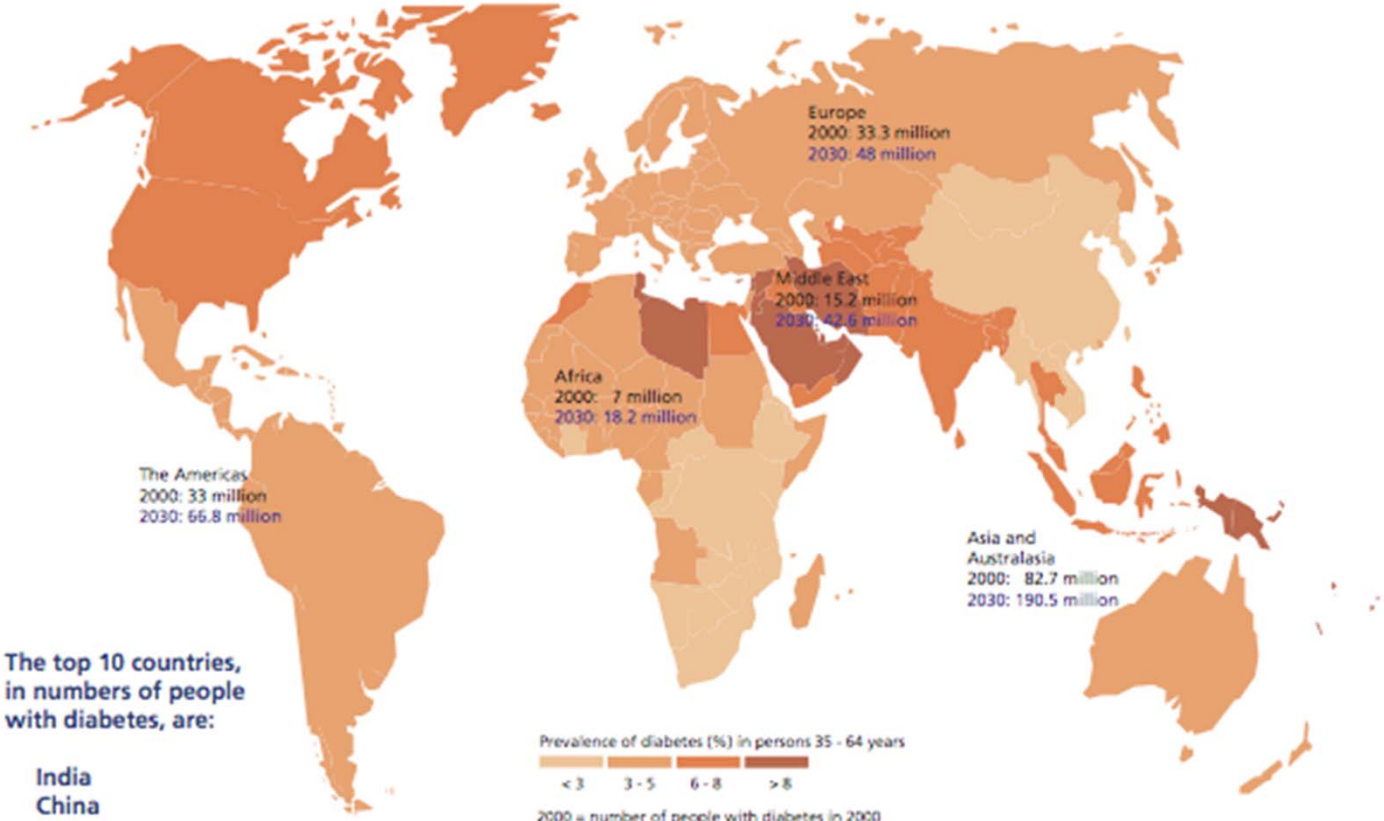
  or

  2–h plasma glucose ≥ 11.1 mmol/l (200mg/dL.

Magnitude of Diabetes Mellitus

- Globally 2005 > than 170 million DM patients
- Global estimates 2010: 285 million DM patients
- Global estimates 2030: 366 to 439 million DM patients.

Prevalence of diabetes



The top 10 countries, in numbers of people with diabetes, are:

India
China
USA
Indonesia
Japan
Pakistan
Russia
Brazil
Italy
Bangladesh

Year		2000	2030
Ranking	*Country*	*People with diabetes (millions)*	
1	India	31.7	79.4
2	China	20.8	42.3
3	United States of America	17.7	30.3

Trends in DM epidemiology

Why the increase?

-Population growth

-Population aging

-Urbanization

-Lifestyle change

-Obesity

Trend

- Most rapid changes in low and middle income countries

DM and blindness: After 15 years of DM estimated:

- 2% become blind
- 10% develop severe visual impairment.

Slide 6

MJC2 I might suggest longer lifespans for diabetics because it is duration of diabetes that is key here
Marissa Carter, 6/2/2011

1 This slide is epi for DM , I think you are refering to DR epi in the comment
Covadonga Bascaran, 7/11/2011

Definition and classification of DR

- Characteristic group of lesions found in the **retina** of individuals that have had **diabetes** for several years.
- It is considered to be the result of vascular changes in the retinal circulation: a **microangiopathy** that exhibits features of both microvascular occlusion and leakage.

lernational classification

- **R0 None**
  - No retinopathy
- **R1 Mild**
  - Microaneurysms only
- **R2 Moderate**
  - More than microaneurysms but not severe
- **R3 Severe**
  - More then 20 haemorrhages
  - Venous beading
  - IRMA
- **R4 Proliferative**
  - New vessels
  - Vitreous haemorrhage

- **M0 No maculopathy**
  - No macular oedema
- **M1 Mild maculopathy**
  - Exudate / oedema away from fovea
- **M2 Moderate maculopathy**
  - Exudate / oedema close to fovea
- **M3 Severe maculopathy**
  - Exudates / oedema at fovea

Slide 8

I1 discuss this slide.
ICRUDPAT, 3/22/2011

2 Covadonga Bascaran, 7/11/2011

Prevalence DR USA (WESDR)

- Prevalence of DR of **any severity** in the diabetic population as a whole is approximately **30%.**

- Prevalence DR with **risk of visual impairment** is approximately **10%**.

Duration	Prevalence
• Type 1 IDDM	
– <5 yrs	13%
– 10-15 yrs	90%
• Type 2 IDDM	
– <5 yrs	40%
– 15-20 yrs	84%
• Type 2 NIDDM	
– <5 yrs	24%
– 15-20 yrs	53%

MJC4

Slide 9

MJC4 I find the prevalence data interesting for type 2 between IDDM and NIDDM groups; is that a general finding for other studies?
Marissa Carter, 6/2/2011

What do we know about the epidemiology of DR

- Mainly based on population-based studies from developed countries.
- Difficulties in comparing data due to varied study methodologies:
  - Population-based/hospital-based or varied by DM type
  - Varied age of inclusion, duration/onset of DM
  - Sample size
  - Definitions and classification.

Examples of DR prevalence surveys

Country	Sample	Age	Prevalence (%)
USA WESDR (1)	996 1370	<30 >30	19.0 28.8
USA LALES (2)	1217	>40	46.9
India-Chennai CURES (3)	1382	>20	17.6
UK Liverpool	395	15-92	33.0
Barbados (5)	636	>40	28.5
Australia Blue Mountains (6)	255	>50	32.0
China Beijing (7)	235	>40	37%

Diabetic retinopathy and blindness

- Leading cause of blindness in **working age population**
- Globally estimated prevalence of blindness due to DR 5% (1.8 million persons) in 2002:
  - 0% (unknown) Africa
  - 3–7% South-East Asia and Western Pacific
  - 15–17% Europe, USA Europe

Risk factors for DR

Risk factor	Modifiable/non modifiable
Duration	No
Poor glycaemic control	YES MJC5
Hypertension	YES
Pregnancy	PARTLY YES
Puberty	NO
Renal disease	PARTLY YES
Hyperlipidaemia	YES

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MJC5 I agree but there is a risk of increased hypoglycemic epidoes and death if control is too tight
Marissa Carter, 6/2/2011

WESDR: Cumulative 10-yr Incidence

VISUAL IMPAIRMENT

- 9.4% in young IDDM
- 37.2% in older IDDM
- 23.9% in older NIDDM

BLINDNESS

- 1.8 % young IDDM
- 4.0 % older IDDM
- 4.8 % older NIDDM

Factors influencing incidence:

- Baseline retinopathy at diagnosis
- Glycaemic management – insulin
- Poor DM control – high HbA1c
- Duration

Management of DR

- Laser – first line treatment for DR
- Vitrectomy
- Experimental treatments
  - Anti-VEGF
  - Intra-vitreal steroid

Management of DR

Stage of Disease	Management options
No DR or moderate non-proliferative DR	Optimize medical glycaemic control, blood pressure and lipid s
Severe non-proliferative DR	Consider scatter (pan-retinal) laser photocoagulation. Better visual prognosis
Proliferative DR	Immediate pan-retinal photocoagulation Additional vitrectomy for high-risk cases
High risk PDR not amenable to laser treatment	Vitrectomy
CSME (clinically significant macular edema)	Focal and or pan-retinal photo-coagulation

Evidence for treatment of DR

Trial	Evidence
Diabetic Retinopathy Study (DRS)	PRP reduces the risk of severe visual loss by > 50 % in high-risk proliferative diabetic retinopathy
Early Treatment Diabetic Retinopathy Study (ETDRS)	1.Focal photocoagulation treatment for macular oedema . 2. No scatter treatment for eyes with mild to moderate NPDR, unless high risk. 3. Early vitrectomy for advanced active PDR. 4. Careful follow-up for all DR patients. 5. No ocular contraindications for aspirin
Diabetic Retinopathy Vitrectomy Study (DRVS)	1.Early vitrectomy in eyes with recent severe vitreous hemorrhage especially if IDDM. 2. Early vitrectomy in very severe PDR

Evidence for prevention

Trial	Evidence
United Kingdom Prospective Diabetes Study (UKPDS)	Lowering elevated blood glucose and BP levels significantly reduces life-threatening complications of type 2 diabetes
Diabetes Control and Complications Trial (DCCT)	Intensive treatment reduces risk of ocular disease (76%), renal disease, and neuropathy

Public health approach – to prevent visual loss due to DM

- **Primary (to stop the DR from occurring)**

  -Health education, dietary/lifestyle changes

  -Early diagnosis of diabetes

  -Control of hyperglycaemia, hypertension, and dyslipidemia
- **Secondary (to prevent blindness from occurring)**

  -Controlling hyperglycemia, hypertension, and dyslipidemia

  -Screening to detect treatable retinopathy MJC6 3

  -Provision of laser photocoagulation
- **Tertiary (to treat the blinding disease)**

  -Vitreo–retinal surgery

Rehabilitation of VI and blind

Slide 19

MJC6 Annual screening or merely unspecified periodic screening because of CE controversis over frequency?
Marissa Carter, 6/2/2011

3 Discussed in later slide in detail
Covadonga Bascaran, 7/11/2011

Screening

- Screening aims to answer simple question:
  - Refer/do not refer for treatment.
  - ➢ Screening is a public health service,
  - ➢ for members of a defined population,
  - ➢ they may not necessarily perceive they are at risk of, or are already affected by a disease or its complications,
  - ➢ are offered a test, to identify individuals who are most likely to benefit from further tests or treatment to reduce the risk of a disease or its complications

Required criteria for screening

Criteria	Diabetic Retinopathy
Well defined, public health problem	YES
Known prevalence	YES
Known natural history	YES
Simple and safe test available	YES
Cost-effective	YES
Acceptability by patients and professionals	YES
Agreed policy on treatment	YES

MJC7

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MJC7 Problem is that a lot of patients don't care

Marissa Carter, 6/2/2011

Components of a screening programme

- Identification of diabetic patients
- Call/Recall mechanism
- Screening method
- Grading
- Referral network
- Treatment and follow-up pathway
- Information system
- Quality assurance

Sensitivity and specifity

- Sensitivity: the fraction of those with the disease correctly identified as positive by the test.
- Specificity: the fraction of those without the disease correctly identified as negative by the test.
- A DR screening program test must achieve 80% sensitivity and 95% specificity. (1)
- A high coverage is essential for an effective screening programme.

MJC8

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Slide 23

MJC8 How do we define "high"? >= 80%
Marissa Carter, 6/2/2011

4 UK programme aims for a minimun of 80%, with the objective to increase coverage anually.
Covadonga Bascaran, 7/11/2011

Screening options

- **Ophthalmoscopy** by trained health personnel
- Lower sensitivity.
- May be the cheaper option in the initial stages
- **Retinal photography**
- Higher sensitivity
- Expensive
- Permanent visual record if digital
- Any ungradeable photos will need clinical examination using ophthalmoscopy.

Screening Personnel

Professional	Ophthalmoscopy		Retinal photographs	
	Sensitivity	Specificity	Sensitivity	Specificity
GP	25-66%	75-98%	87%	85%
Optometrists	48- 82%	94%	97%	87%
Ophthalmol	43 -79%	89-100%	96%	98%
Diabetologist	27-73%	98%	89%	92%

Intervals for screening

- Regular and timely to prevent blindness.
- Cost effective: systematic screening is expensive.
- Acceptability : especially as patients are asymptomatic
- Long intervals – may reduce coverage .

Liverpool diabetic eye study:

- No DR– no risk factors – **3 years**.
- No DR – insulin use >20 yrs – **1 year**
- Mild pre-proliferate – **4 months**
- Longer intervals for patients who are low risk (70 %) = cost savings

Trade off between performance and cost

- Local decisions need to be made based on:
- Available infrastructure
- Available resources
- Social models for service delivery
- Models of screening technique, will need to be country specific.
- Standardised definitions and performance measures allow for comparable measures and maintaining quality.

Models of screening

- **Static :** Based at a health/optometry center/GP practice. Must be linked to an image grading center
- **Mobile screening:** An equipped van travels in a catchment area**.** Also linked to image grading center.

Pathways:

All photo images go to reading center for grading.

Grading and advice for referral is communicated to patient.

Ungradeable images – patients see an ophthalmologist.

Quality checks – done by ophthalmologist.

Cost effectiveness of screening for DR

- Screening is cost effective than opportunistic examinations.
- Screening annually versus every 3 years and 5 years has shown to be marginally beneficially .
- Greatest benefit for annual screening is for younger , poorly controlled diabetics.
- Most modeling done to date is based on populations on high income countries.

Acceptance and barriers of screening for DR

Compliance challenges:

- Asymptomatic condition
- Longer screening periods in lower risk cases :

  - might lead to poorer compliance

  -wrong message: visual loss not “my problem”
- Multiple health problems and health appointments.

Barriers:

- Lack of awareness about DR as cause of blindness
- Fear of laser
- Inconvenience
- No family/employers support
- Guilt about glycaemic control
- Retinal images good impact for health education

Health education for DR

- Diabetic patients should receive adequate information regarding glycaemic control, diet and exercise
- Lack of persistent behavioural change in patients despite health education – remains a challenge
- Marketing approach about the regular consultations and treatment is essential
- Orient educational messages to each culture

Conclusions on public health for DR

- DR is the leading cause of blindness in the working population and the trend is for it to increase.
- There are evidence-based strategies for the DR management and prevention of blindness.
- Screening for DR is a cost-effective tool for prevention of visual loss due to DR.
- Screening models need to be tailored for local resources.
- Health education and addressing patient barriers are essential to increase compliance with screening and treatment.