Echocardiographic Diagnosis of Rheumatic Heart Disease

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First episode of ARF

Precipitating event: infection with a strain of GAS carrying specific virulence factors

Environmental factors, especially overcrowding

Repeated GAS infections

Susceptible host

‘Priming’ the immune response

Molecular mimicry between GAS antigens and host tissues

Genetically-determined host factors

Exaggerated T cell mediated immune response

Episodes of recurrent ARF

Repeated or ongoing infections possibly driving the valvular inflammatory response*

Rheumatic heart disease

GAS, group A streptococcus

*GAS and possibly other infections

3 pillars of Rheumatic fever knowledge

1. Without Group A streptococcus there would be no rheumatic fever
2. Recurrences of ARF can be prevented by the continuous administration of Benzathine penicillin
3. Severe RHD shortens life
Severe RHD – shortens life

Without Penicillin

20 yr mortality from RHD 30-80% most dying before aged 30

USA   Bland & Jones Circulation 1951

Mean age death from RHD < 25 years


India   Indian Heart J 2002:54:54-58
RHD: disease burden in adulthood

* Data from the Top End Rheumatic Heart Disease Control Program.
Pregnancy in pts with RHD and prosthetic heart valves
NWH-GLH surgical data base 1972-1992

• Disastrous results with warfarin for fetus (teratogenic 1st trimester, fetal bleeding 2nd trimester)

• 59% fetal loss mechanical valve vs 7% bio prosthesis versus disastrous maternal results without warfarin

• high incidence of maternal valve complications (20%) if change to heparin including thromboembolism, maternal death, thromboembolism and major post partum haemorrhage

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Freedom from all late valve related events

At 14 yrs

- Repair 71%
- MVR 15%
- Bioprosthetic 0%

Remenyi et al. WJPCS 2013 in press
Untreated RHD in childhood

• 44-80% of children untreated ARF & RHD progress to cardiac failure requiring medical and surgical treatment within 20 years
  Bland & Jones Circulation 1951: 4:836-41
  Cohn & Lingg JAMA1943:121:1-8

• ARF Recurrences lead to progressive worsening of RHD

• Hence importance of secondary prophylaxis
Natural history of RHD with good secondary prophylaxis

No, mild or moderate carditis: very good
- no detectable heart disease after 10 years

severe RHD
- poor prognosis
- valves too damaged, cardiac muscle failure

Tompkins et al J Chronic disease 1972:45:543-551
Feinstein et al Annals Int Med 1964: 60 (suppl)87-123
40% of adults presenting with RHD never had an episode of ARF

- Tairawhiti, New Zealand 37%

- Why can ARF be silent? - when there are no joint symptoms
  - because mild moderate and even severe RHD is asymptomatic. Only when get symptoms of cardiac failure (breathlessness etc)
Pathogenesis of RHD past 50 years – USA model

Susceptible Host + GAS

Symptomatic Sore Joints
  ARF

Heart murmur
  Chorea

Pregnancy
  Mitral stenosis in adults

RHD
  Mitral and aortic regurgitation

RHD

RHD

RHD
Evidence of clinically silent episodes of rheumatic fever

Presentations with RHD
Child or adult heart murmur - uncommon
Indolent carditis – uncommon
Acute on chronic ARF - frequent
Chorea - common
Bacterial endocarditis in adults and children (18% GLH-SCH series) – not rare
Pregnancy and mitral stenosis (or CCF with AR/MR) – common
Older Adults with RHD/CCF – literature 40%
Stroke in adults – uncommon

TOTAL: rheumatic fever without classical arthritis/ARF is common
Bland and Duckett Jones

*Circulation* 1951

- 1000 Pts followed from 1928 for 20 years
  - 347 with no murmur with ARF
- 53% (154/347) developed mitral stenosis (most without a recognized recurrence of RF)
- Seems very likely that these patients had subclinical carditis with mitral regurgitation that evolved to mitral stenosis
Portable echocardiography in RHD

screening for secondary prevention / early detection

Challenges of Screening for RHD using echo

Different criteria used

• NIH at Lancefield 2006
• WHO 2004
• Countries adapted

Over-diagnosis?
Pathogenesis of ARF to RHD

Susceptible Host

Symptomatic Sore Joints ARF

Asymptomatic Silent RF episode with carditis?

RHD
Optimising echocardiographic screening for rheumatic heart disease in New Zealand: not all valve disease is rheumatic

Rachel H. Webb,¹,² Nigel J. Wilson,¹ Diana R. Lennon,²,³,⁴ Elizabeth M. Wilson,² Ross W. Nicholson,³ Tom L. Gentles,¹ Clare P. O'Donnell,¹ John W. Stirling,¹ Irene Zeng,⁵ Adrian A. Trenholme³

¹Green Lane Paediatric and Congenital Cardiology Department, Starship Children's Hospital; ²Paediatric Infectious Diseases, Starship Children's Hospital; ³KidzFirst Children's Health, Counties Manukau District Health Board; ⁴Department of Paediatrics, School of Population Health, University of Auckland; ⁵Department of Cardiac Physiology, Green Lane Cardiac Services, Auckland City Hospital, Auckland, New Zealand
Screening for previously undiagnosed RHD in NZ

2007- 2012
3,700 decile 1-2 students
400 decile 10 students

Auckland – research funding

non Auckland DHBs
Paediatrician – Public Health – Nursing - Cardiology partnership
+ good community buy in
NZ numbers: RHD echo findings

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<th>High prevalence regions</th>
<th>Heart Surgery</th>
<th>BPG</th>
<th>Possibles/Borderline</th>
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<td>South Auckland</td>
<td>1142</td>
<td>2</td>
<td>25 (2.4%)</td>
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<tr>
<td>Tairawhiti</td>
<td>685</td>
<td>1</td>
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<tr>
<td>Bay of Plenty</td>
<td>553</td>
<td></td>
<td>3 (0.5%)</td>
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<tr>
<td>Kaitaia</td>
<td>635</td>
<td>1</td>
<td>5 (0.8%)</td>
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<tr>
<td>Porirua (WHF)</td>
<td>621</td>
<td></td>
<td>8 (1.3%)</td>
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<tr>
<td>North Shore (low prev)</td>
<td>400</td>
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Challenges for RHD diagnosis

Need for Standardization of diagnostic criteria

Aim: to define the minimal diagnostic criteria for RHD

Evidence based

should allow more consistent identification of individuals with RHD without a clear history of ARF
International Standardisation of Echocardiographic Diagnosis of RHD

Bo Remenyi, Nigel Wilson and Jonathan Carapetis
Evidence-based guidelines for echo diagnosis of RHD

- An international advisory group was formed in 2009
- 21 investigators from six continents
- Web based system for echo review
- Combined their clinical experience with detailed systematic literature review
World Heart Federation criteria for echocardiographic diagnosis of rheumatic heart disease—an evidence-based guideline

Bo Reményi, Nigel Wilson, Andrew Steer, Beatriz Ferreira, Joseph Kado, Krishna Kumar, John Lawrenson, Graeme Maguire, Eloi Marijon, Mariana Mirabel, Ana Olga Mocumbi, Cleonice Mota, John Paar, Anita Saxena, Janet Scheel, John Stirling, Satupaitea Viali, Vijayalakshmi I. Balekundri, Gavin Wheaton, Liesl Zühlke and Jonathan Carapetis
WHF Echo criteria for RHD

**Echo criteria for children ≤ 20 years of age**

**Definite RHD (either A, B, C or D):**
- A) Pathological MR and at least two morphological features of RHD of the MV
- B) MS mean gradient ≥ to 4 mmHg (NB – exclude congenital MV anomalies)
- C) Pathological AR and at least two morphological features of RHD of the AV (NB – exclude bicuspid aortic valve and dilated aortic root)
- D) Borderline disease of both the aortic and mitral valves as defined below*

**Borderline RHD (either A, B or C):**
- A) At least two morphological features of RHD of the MV without pathological MR or MS
- B) Pathological MR
- C) Pathological AR

**Normal Echocardiographic findings (all A, B and C):**
- A) MR that does not meet all four Doppler criteria (Physiological MR)
- B) AR that does not meet all four Doppler criteria (Physiological AR)
- C) An isolated morphological feature of RHD of the MV or the AV (e.g. valvar thickening) without any associated pathological stenosis or regurgitation
Echocardiography has shown high levels of RHD prevalence, has increased **advocacy** for better RHD control in those regions.

Impact on reduction in disease burden has not been evaluated except in some regions:

- e.g. Tonga
Natural history of echocardiographically detected RHD

- Emphasis has been on mild/minor abnormalities
- Emphasis must now shift to Definite RHD by WHF criteria
  - the cardiology community need to show that latent definite RHD is the same as definite RHD following episode (s) of ARF in terms of
    § 1) progression of RHD if untreated
    § (and less likely) 2) recurrence of ARF
Scale of RHD

0
Normal

1
Borderline RHD

2
Definite RHD - mild

3
Moderate (mitral regurgitation)

4
Severe

5
Severe + symptoms

Definite RHD Registry

Time
Prediction?

Definite RHD Registry

Years

0  2  4  6

0  1  2  3  4  5

Poor Prophylaxis

Good Prophylaxis
What is natural history?

Much harder for prophylaxis to be effective
- as the natural history (so far) is more improve
than get worse (3 small FU studies to date)
Summary and conclusions

Severe RHD shortens life expectancy

- Morbidity high
- 600-800 admissions per year
- nearly 200 deaths per year

40% of adults with severe RHD do not have a history of ARF

- echo screening for RHD is feasible but internationally there has been over-diagnosis
- reproducibility & accuracy improved by WHF criteria
Conclusions (2)

• Advocacy for RHD increased

• new insights into pathogenesis of RHD but need to define disease progression of definite RHD

• potentially prevent severe RHD
  – not proven that this can be implemented on a population basis to reduce prevalence RHD
Conclusions – international (2)

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<td>7.</td>
<td>Roberts K et al. Screening for rheumatic heart disease: current approaches and controversies Nature Reviews Cardiology 2013:10, 49-58</td>
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