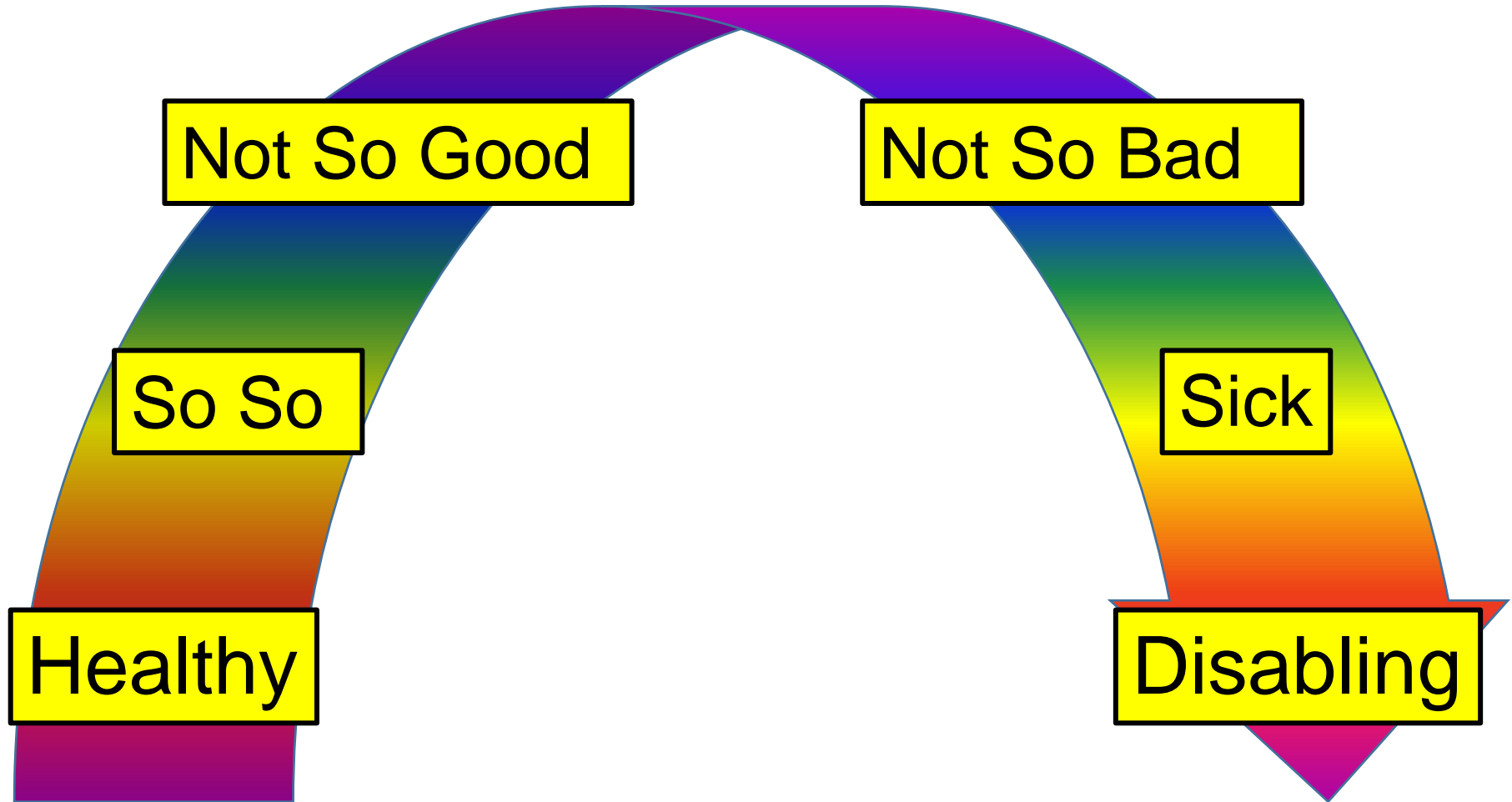


Asymptomatic 1<sup>st</sup> degree AV block,  
BBB, or Fascicular block;

Which one is sick heart?

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박형욱

# Cardiac conduction disease continuum



# Effects of aging on the conduction system

- Calcification of the cardiac skeleton
  - : particularly in the region including the central fibrous body and the left-sided valves (aortic and mitral valve rings).
- The AV node, AV bifurcation, as well as the proximal left and right bundle branches are located near the central fibrous body, and are thus vulnerable to slowed signal transmission with increasing age-related changes.

# Effects of aging on the conduction system

- The PR interval undergoes a modest but significant prolongation with advancing age.
- Mean PR interval occurred between the third and ninth decades of life.

**Men**

**Vs.**

**Women**

**153 ms -- 182 ms**

**148 ms -- 166 ms**

# Age-associated changes in the components of atrioventricular conduction in apparently healthy volunteers

- 185 healthy volunteers
- 20-83 years from the Baltimore Longitudinal Study of Aging
- Normal rest (PR interval < 210 ms) and exercise ECGs
- P-R interval increased with age
- Due entirely to prolongation of the interval between the P wave onset and His bundle potential, i.e., the P-H interval
- No age-associated change in the H-V interval,  $p = \text{NS}$ .
- The P-H interval prolongation with age was localized to the P-R segment proximal to His bundle activation

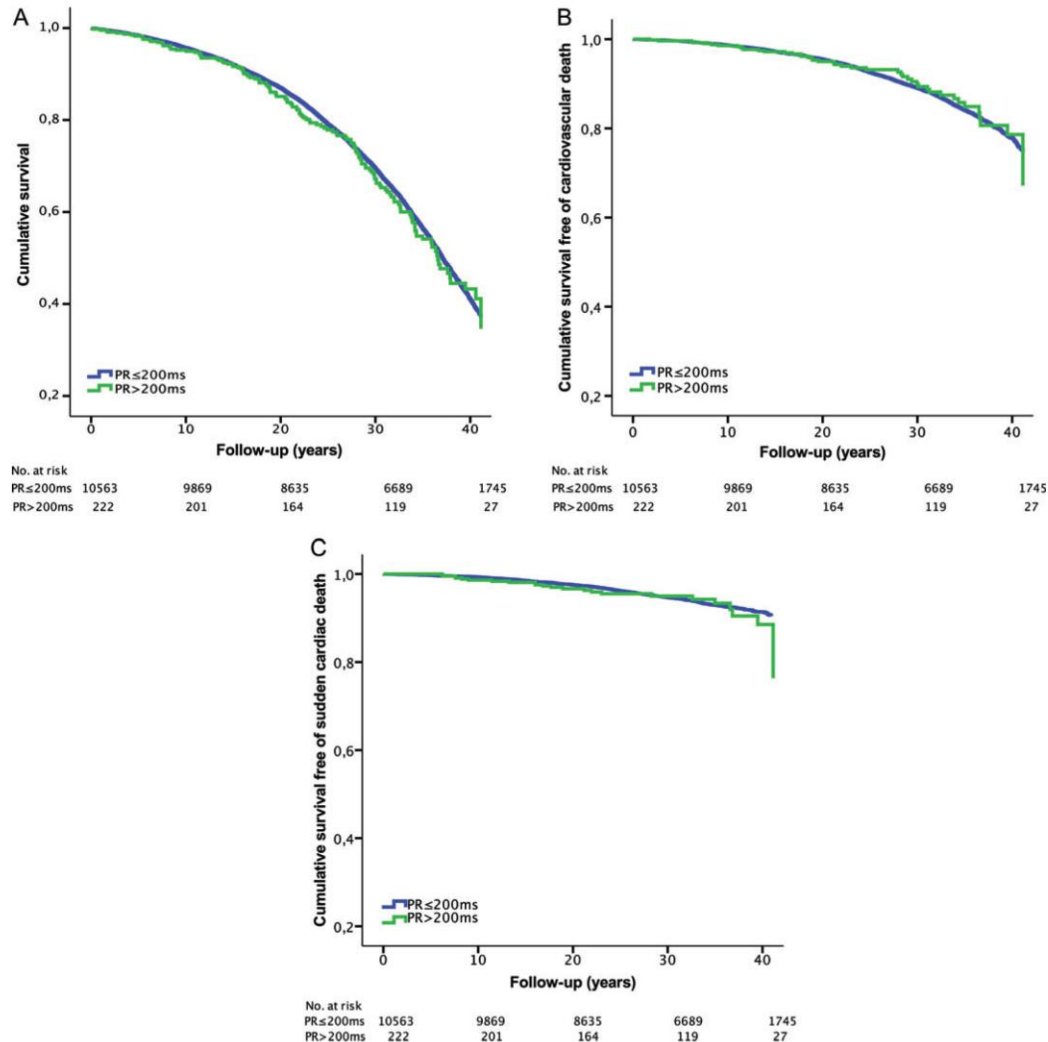
# Effects of aging on the conduction system

- QRS duration shows no significant age relationship
- QRS axis does shift leftward with age
- Mean QRS axis shift 56 to 8 degrees between the third and ninth decades, with corresponding lower limits shifting from  $-3$  to  $-60$  degrees.
- Left axis deviation (defined as a QRS axis  $< -30$  degrees) increases to 20% by the tenth decade

# The natural history of primary first-degree atrioventricular heart block

- PR interval of > 200 ms
- Usually asymptomatic and is associated with normal aging.
- First-degree AV block in healthy older men; 3-4 %
- Resting ECGs of 3983 healthy airmen
- Followed for 30 years
- By the seventh decade, 20% of study participants had a PR interval of at least 200 ms but a PR interval  $\geq$  220 ms was seen in only 4% of this group
- No significant differences in cardiac morbidity or mortality were observed in these latter individuals compared to age-matched controls during 30 years of follow-up

# Prognostic significance of prolonged PR interval in the general population



“ In the middle-aged general population, prolonged PR interval normalizes in a substantial proportion of subjects during the time course, and it is not associated with an increased risk of all-cause or cardiovascular mortality “



# Long-term Outcomes in Individuals with a Prolonged PR Interval or First-Degree Atrioventricular Block

- 20-year follow-up data from 7,575 individuals in the Framingham study (mean age  $46 \pm 15$  years at baseline)
- Increased risks of atrial fibrillation, pacemaker implantation, and all-cause mortality associated with PR interval prolongation, even within the normal range.

# First-degree atrioventricular block is associated with heart failure and death in persons with stable coronary artery disease: data from the Heart and Soul Study

- 938 patients with known stable coronary disease and mean age 66 years
- First-degree AV block (defined as a PR interval  $\geq 220$  ms) and an **increased risk of both heart failure hospitalization, and overall mortality** over a 5-year follow-up period

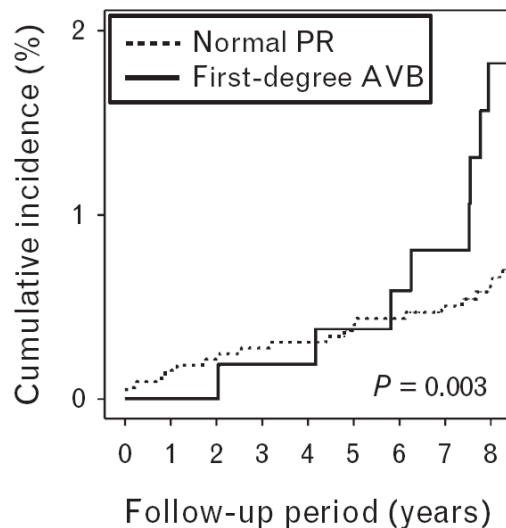
# First-degree atrioventricular block is associated with advanced atrioventricular block, atrial fibrillation and left ventricular dysfunction in patients with hypertension

- 3816 (mean age,  $61.0 \pm 10.6$  years; men, 47.2%) with HTN
- Normal PR interval ( $120 \text{ ms} < \text{PR} < 200 \text{ ms}$ ) and first-degree AVB ( $\text{PR} > 200 \text{ ms}$ )
- 14.3%,  $9.4 \pm 2.4$  years.
- Incidence and cumulative incidence of advanced AVB, atrial fibrillation and left ventricular dysfunction in patients with first-degree AVB were significantly higher than in patients with normal PR interval.

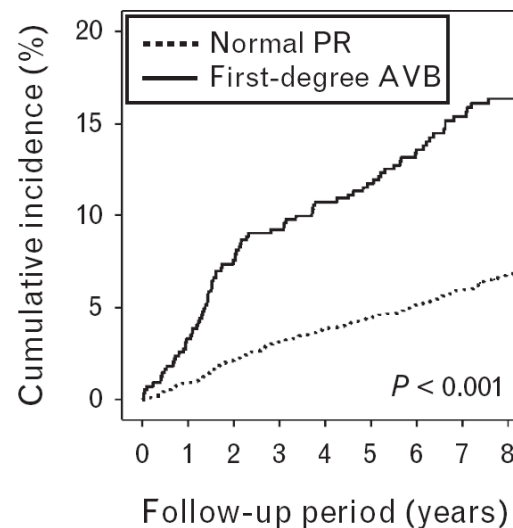
# First-degree atrioventricular block is associated with advanced atrioventricular block, atrial fibrillation and left ventricular dysfunction in patients with hypertension

- First-degree AVB is an independent risk factor for future development of advanced AVB, atrial fibrillation and left ventricular dysfunction in patients with hypertension

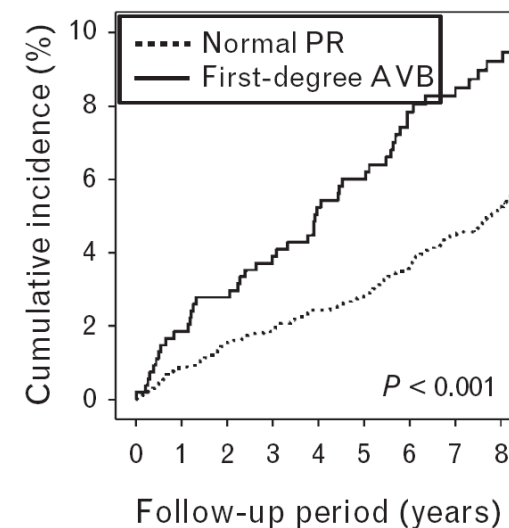
(a) Advanced atrioventricular block



(b) Atrial fibrillation



(c) Left ventricular dysfunction

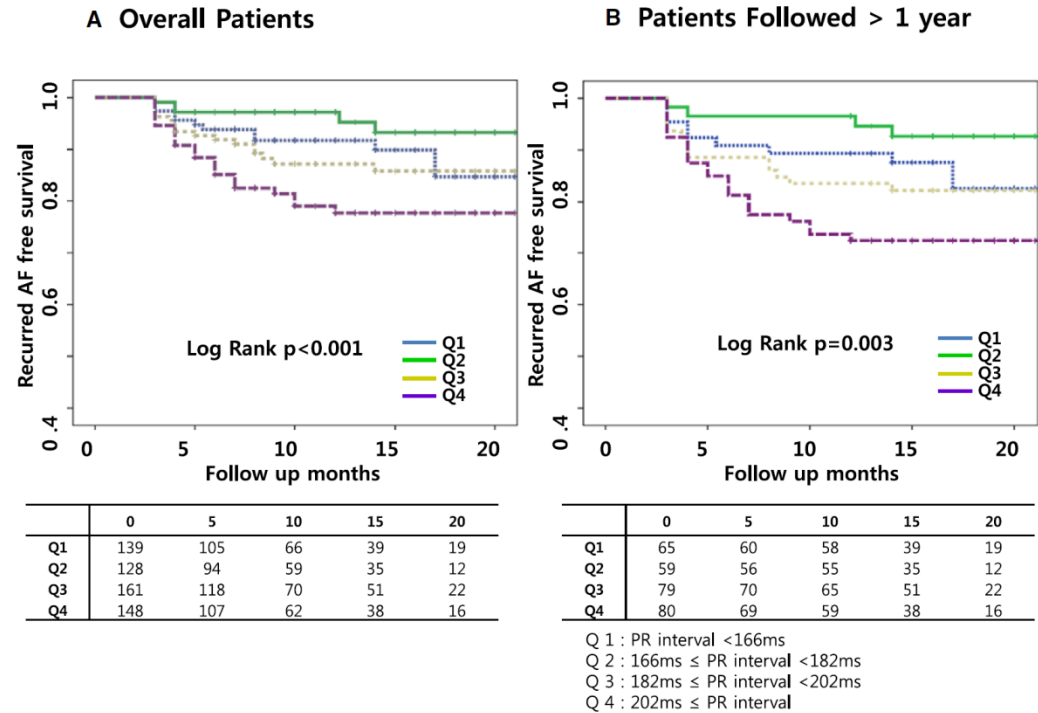


# Prolonged PR Interval Predicts Clinical Recurrence of Atrial Fibrillation After Catheter Ablation

- 576 patients with AF who underwent RFCA.
- 4 groups based on the quartile values of the PR interval (166, 182, and 202 ms),
- Left atrium (LA) volume (CT; Computed tomography), LA voltage (NavX), and clinical outcome of AF ablation.
- Q4 had the greatest LA dimension and volume index and lowest LA appendage-emptying velocity and LA voltage compared with the others.

# Prolonged PR Interval Predicts Clinical Recurrence of Atrial Fibrillation After Catheter Ablation

- The PR interval was closely associated with advanced LA remodeling due to AF, and had a noninvasive significant predictive value of clinical recurrence of AF after RFCA



# First-Degree AV Block—An Entirely Benign Finding or a Potentially Curable Cause of Cardiac Disease?

Patients		Increased risk of mortality (23,29)	Higher prevalence of heart disease (22)
		Worse clinical state (31)	Higher risk of hospitalization (22)
		Poor CRT response (28,30,32)	
Community	Low prevalence (14)	Increased risk of AF development (18,19)	Highest prevalence (14)
		Increased risk of PM implantation (19)	Higher prevalence of heart disease in AVI (14)
		Increased risk of mortality (19,20)	AVI associated with increased risk of HF (21)
Healthy	Low prevalence (6,7,10)	Higher prevalence (9)	
	No obvious clinical impact (6)	Conflicting evidence concerning CHD (9,13)	
	PR interval prolongs over time (6,10)	Higher morbidity? (10)	
	Young	Middle-aged	Elderly

“ Prognostic significance of first-degree AV block may differ, **depending on whether cardiac disease is present** “

# Right bundle branch block

- Framingham Heart Study
- the incidence of RBBB peaked in men in the seventh decade, while a continued rise occurred in women throughout the study period
- 1.3%
- subsequent incidence of coronary artery disease was 2.5 times greater ( $P < 0.001$ ) and congestive heart failure was almost 4 times greater ( $P = 0.02$ ) in patients with RBBB compared to those without by the end of the study period.



# Right bundle branch block: long-term prognosis in apparently healthy men

- In the BLSA, RBBB was observed in 39 of 1142 (3.4%) men on resting ECG, of whom 24 (2.1%) had no evidence of associated cardiac disease. Mean age on presentation with, or development of, RBBB was  $64 \pm 13.5$  years.
- In both the BLSA and Framingham cohorts, the diagnosis of RBBB in persons without concurrent clinical heart disease was not associated with major adverse cardiac events

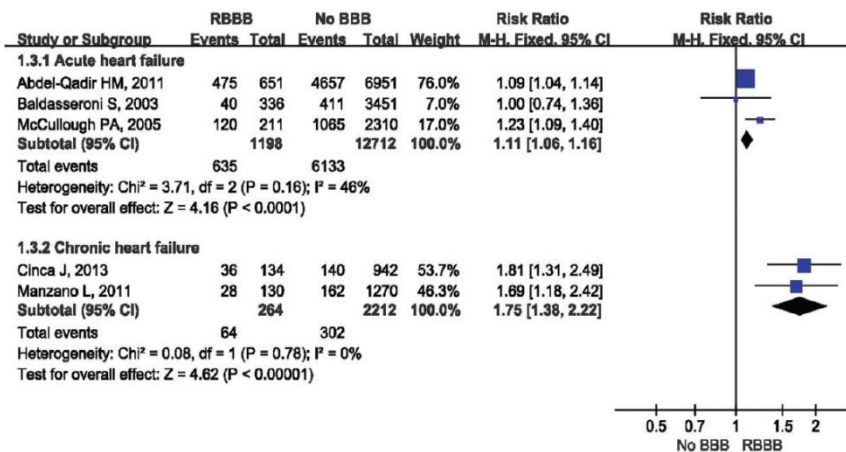
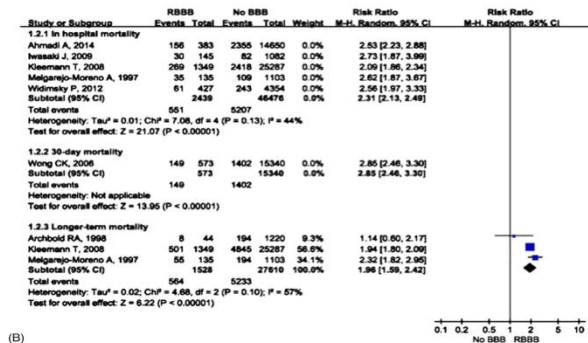
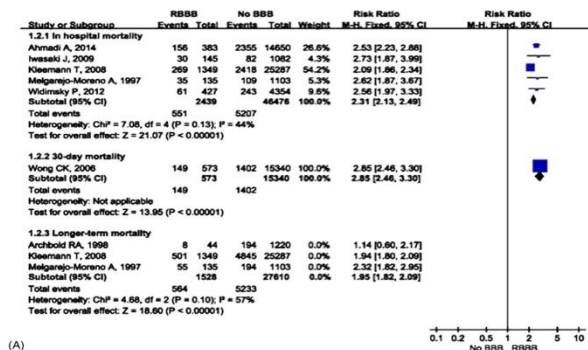
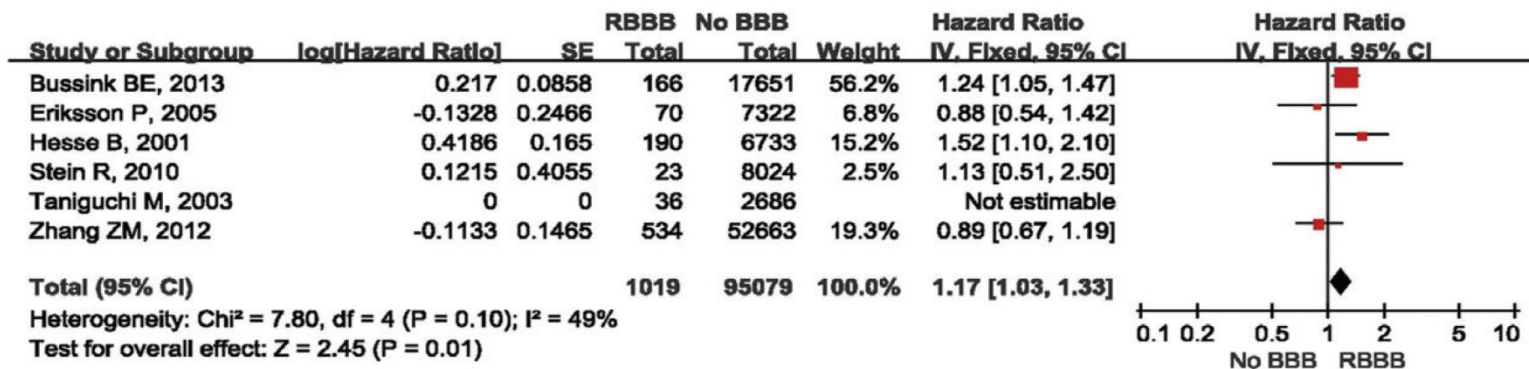
# The epidemiology of right bundle branch block and its association with cardiovascular morbidity-The Reykjavik Study

- In the Reykjavik Study, RBBB increased in prevalence from 0% in persons 30–39 years to 4.1% of men and 1.6% of women 75–79 years old.
- In men but not women, RBBB was associated with cardiomegaly, ischemic heart disease, and arrhythmias on resting ECG.

# The Prognostic Significance of Right Bundle Branch Block: A Meta-analysis of Prospective Cohort Studies; Nineteen cohort studies

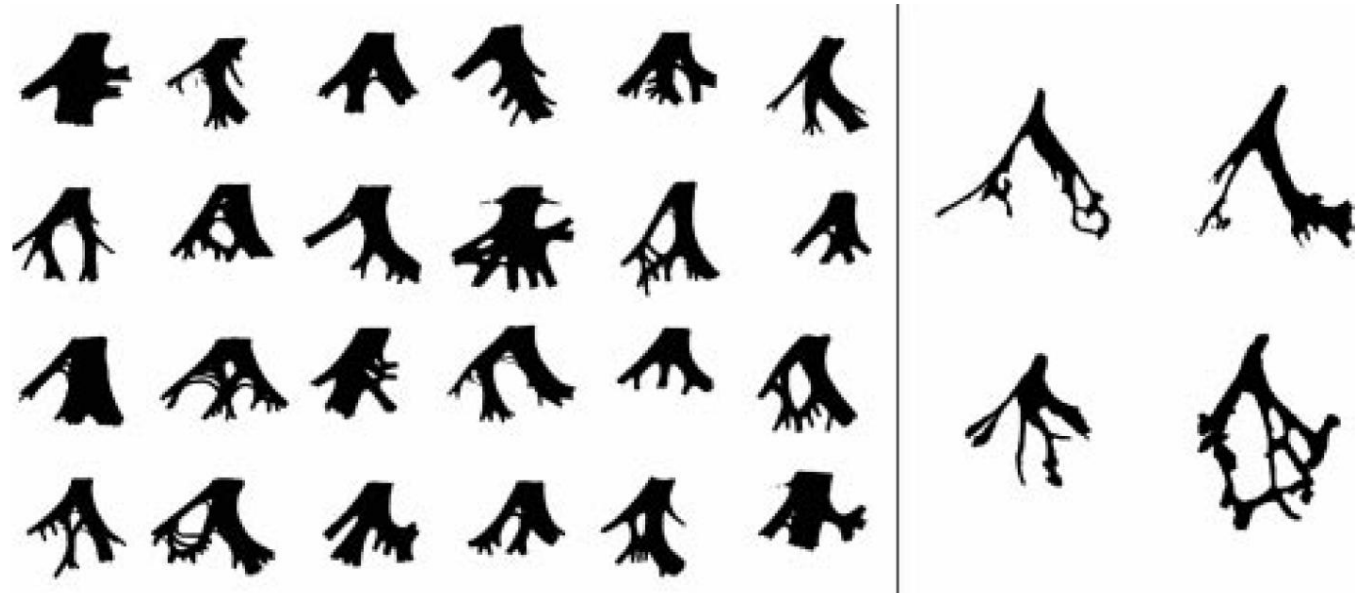
- **General population** with RBBB:
  - Pooled adjusted HR for **all-cause mortality** was **1.17**
  - Risk of cardiac death (HR: 1.43)**
- **Patients with RBBB** and acute MI:
  - Pooled risk ratio was 2.31 for in-hospital mortality
  - 2.85 for 30-day mortality**
  - 1.96 for longer-term mortality.
- **Patients with RBBB** and Acute HF
  - Pooled risk ratio of all-cause mortality was 1.11
- **Chronic HF patients; 1.75**

# The Prognostic Significance of Right Bundle Branch Block: A Meta-analysis of Prospective Cohort Studies; Nineteen cohort studies



# Left bundle branch block

- More specific for the presence of cardiovascular disease (e.g. antecedent hypertension, cardiac enlargement, cardiomyopathy, or coronary heart disease).

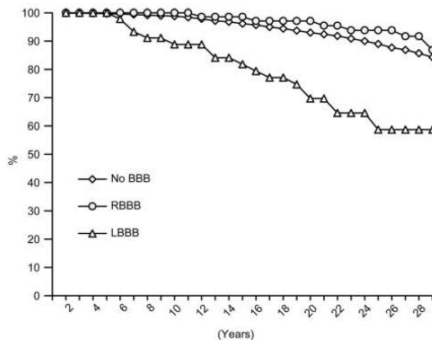


- The prognosis is closely tied to that of the underlying heart disease.

# Left bundle branch block

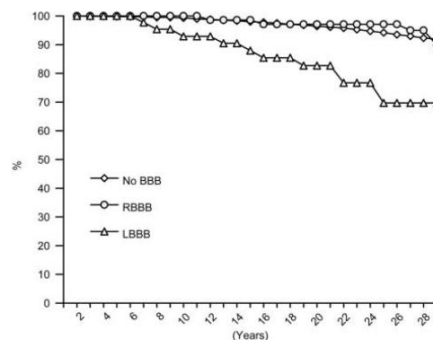
- The Irish Heart Foundation (n=110,000)
- Revealing 112 subjects (0.1%) with LBBB and no prior history of hypertension or heart disease.
- Cardiovascular disease developed in more patients with LBBB than in controls (21% vs 11%; P=0.04)

Fahy GJ, et al. Am J Cardiol. 1996; 77(14):1185–90



Numbers at risk:

Year	0	5	10	15	20	25
No BBB	7276	7118	6804	6281	5588	4406
RBBB	70	70	69	64	58	46
LBBB	46	44	38	34	28	19



Numbers at risk:

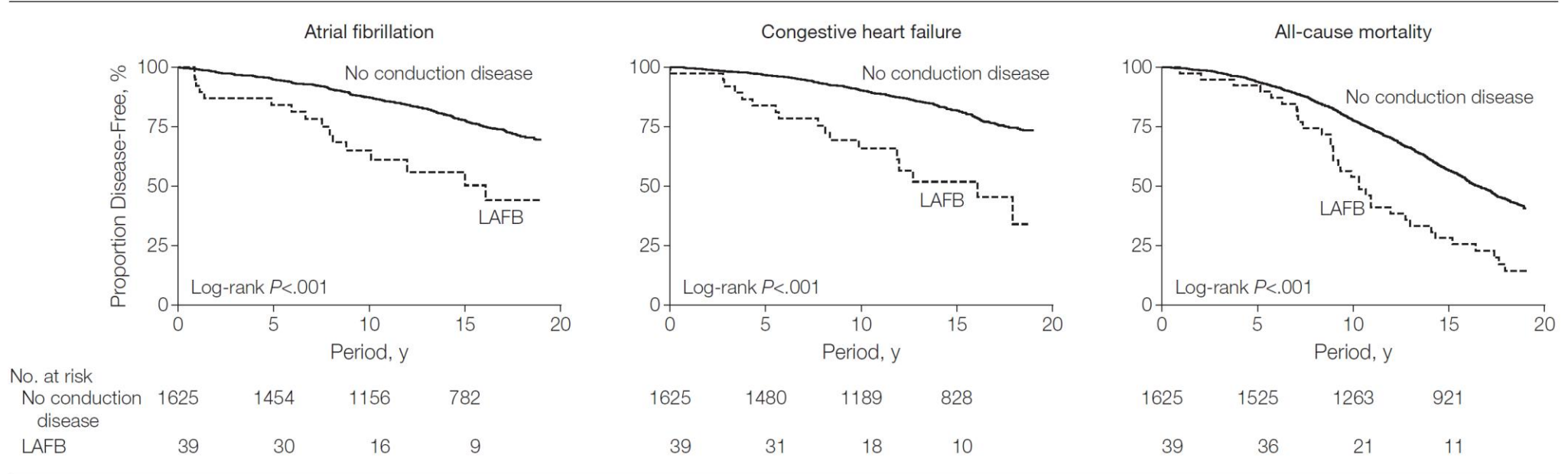
Year	0	5	10	15	20	25
No BBB	7276	7118	6804	6281	5588	4406
RBBB	70	70	69	64	58	46
LBBB	46	44	38	34	28	19

Bundle-branch block in middle-aged men: risk of complications and death over 28 years: The Primary Prevention Study in Gothenburg, Sweden

Eriksson P, et al. EurHeart J 2005; 26: 2300–2306

# Long-term Outcomes of Left Anterior Fascicular Block in the Absence of Overt Cardiovascular Disease

**Figure.** Unadjusted Kaplan-Meier Estimates of Proportions of Individuals With and Without Left Anterior Fascicular Block (LAFB) Developing Atrial Fibrillation, Congestive Heart Failure, or Death



# The resting electrocardiogram as a screening test. A clinical analysis

- Resting ECG predicts cardiac disease?
- Screening ECG is to detect disease whose effects can be prevented by early treatment
- A screening ECG can also serve as a "baseline" tracing. Two studies have shown that the baseline tracing has little effect on decision making in the emergency room.
- The evidence does not support doing a screening ECG in men without evidence of cardiac disease or cardiovascular risk factors.



# Which one is sick heart?

- LBBB; Most sick

# Which one is sick heart?

- LBBB; Most sick

- RBBB  $\approx$  LAHB ;

cause or effect, modest

# Which one is sick heart?

- LBBB; Most sick

- RBBB  $\approx$  LAHB ;

Cause or effect, modest

- First degree AV block;

Possible

Needs more results

**Thank you for  
attention**