Toby Rickard-Elliott is born: film editor, lover of history and London, one of the good guys

Martin, Lesley and Becan Elliott

1983 - 2009
The Heart; an Introduction
I treat congenital disorders of the heart and lungs. What could possibly be relevant about this?
Through synergy with infectious diseases, undernutrition causes 35% of child deaths.
Reduction In Global U5MR By Disease, 2000 to 2010

Deaths per 1,000 births

- Pneumonia
- Diarrhoea
- Measles
- Preterm birth complications
- Intrapartum related events
- Other conditions
- AIDS
- Meningitis
- Neonatal Tetanus
- Malaria
- Neonatal Pneumonia
- Other conditions
- Neonatal sepsis/meningitis
- Neonatal diarrhea
- Congenital abnormalities
- Injury

data from the Child Health Epidemiology Reference Group
Anno domini 1519–1579
mortality of surgery for congenital heart disease

Mortality (%)

Year

Hole in heart baby lives!

Hole in heart baby dies!
the heart is **special** to people

“Man naturally has a great curiosity about the nature of his inside.”

RK French (Wellcome Unit for the History of Medicine)1978
**Gilgamesh**, King of Uruk in Mesopotamia

$\approx 2600$BC

“I touched his heart, but it does not beat at all”

van Tellingen, C. *Neth Heart J* 2009;17:130-5
the heart

- starts working within days of conception
- works ceaselessly
- beats 100k/day, 40m/year
- 3 billion in average lifespan
- supplies distribution network of 97,000 km of vessels

and most of the time you don’t notice it’s there
the heart is **special** to people

soul  emotion  love  strength

not just form and function
the heart is **special** to people

16thC BC, Papyrus of Ani, The Book of the Dead
described in Baig, MN et al Neurosurg Focus 23 (1):E3, 2007
the brain; not so special?
the heart is **special** to humans

disposition, feelings, sense of intention
the heart is special to humans

various Sanskrit texts illustrate the importance of the heart in ‘making moral judgements’

15-12th C BC, RigVeda
described in Baig, MN et al Neurosurg Focus 23 (1):E3, 2007
The heart is special to humans.

The heart is the most important organ in the body, and the seat of the soul.

Empedocles 5th C BC
the heart is **special** to humans

*Philolaus 5th C BC*

\[
\begin{align*}
nous \text{ (mind)} & \approx \text{brain} \\
psyche \text{ (soul)} & \approx \text{heart} \\
\text{(growth)} & \approx \text{umbilicus}
\end{align*}
\]
the heart is special to humans

the heart is the seat of wisdom

the heart is mentioned over 420 times in the Bible
the heart is special to humans

“Your true nature lies in the internal spirit….We call it the ‘heart’…Not to the lump of flesh which is found in the left side of the chest; it has no special merit and is possessed also by beast, the dead and can be seen by the external eye….The true nature of the heart is not of this world…the external flesh is a vehicle, and all the limbs and organs of the body are its soldiers…the heart is the monarch of the entire body.”

the heart is a pump
in the 15th & 16th century

‘astonishment was replaced by reasoning and interfering’

van Tellingen, C. Neth Heart J 2009;17:130-5
the correct circulation began to be understood around the time of Thomas Gresham in the 16th C
Versalius 1514 - 1564

Harvey 1578 - 1657
flow, valves & pulse
my predecessors did not always get it right
a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fume thereof nearest resembling the horrible stygian smoke of the pit that is bottomless.

Matthew Gwinne

Peter Mounsell

Death of Queen Elizabeth

Act of union debated

Matthew Gwinne

Peter Mounsell
in 1620, Matthew Gwinne became commissioner for tobacco; ‘unscrupulous Government officials controlling the licensed traffic in tobacco’

“Thomas Winston made no original discoveries, and showed no acquaintance with Harvey’s work on the circulation”
how does this amazing organ develop?
knowing your **left** from your **right**

the primitive node
The Scale of Things

40w
20w
14w

andrew cook

Change in size
Sequential Segmental Analysis

★ The approach to analysis

✓ Analyse the heart in 3 segments
✓ Limited number of patterns within each segment
✓ Limited number of ways segments can connect
✓ Any number of associated lesions
Analysis/Description of Congenital Heart Disease

Richard and Stella van Praagh

American system

Bob Anderson
Anton Becker + others

European system

International Paediatric & Congenital Cardiac Code

www.IPCCC.net
Thousands of Diagnoses, Thousands of Terms

there is so much to put right
what can go wrong

superior vena cava
inferior vena cava
right atrium
left atrium
right ventricle
left ventricle
pulmonary veins
pulmonary artery
aorta
abnormal or persistent communications

atrial septal defect

ASD
atrial septal defect
ASD
atrial septal defect
ASD
Ultrasonography

Dr Carl Helmuth Hertz, 1953
working with Dr Inger Edler

cardiac echocardiography, 1965
Atrial Septal Defect

- Assess defect diameter & margin size – suitability for device anchorage.
- Quantify the shunt (Qp/Qs) – Note: PA flow velocity may be high due to increased flow volume.
- Quantify right heart volume and function – evaluate volume overload.
- Look for sinus venosus defect (assess for PAPVD – right upper vein).

Fig. 13.1.

Schematic drawing showing the various positions of the holes that permit interatrial shunting:

- Superior sinus venosus defect
- Primum atrial septal defect
- Secundum atrial septal defect
- Inferior sinus venosus defect
- Coronary sinus defect

atrial septal defect
ASD
Assess defect diameter & margin size – suitability for device anchorage.

Quantify the shunt (Qp/Qs) – Note: PA flow velocity may be high due to increased flow volume.

Quantify right heart volume and function – evaluate volume overload.

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Fig. 13.1. Schematic drawing showing the various positions of the holes that permit interatrial shunting:

- Superior sinus venosus defect
- Primum atrial septal defect
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- Inferior sinus venosus defect
- Coronary sinus defect

MRI

atrial septal defect
ASD
abnormal or persistent communications

ventricular septal defect (VSD)
Ventricular Septal Defect

Assess position and size of defects – possibly multiple defects.

The shunt will be proportional to the size of the defect, and the SVR:PVR ratio.

Quantify ventricular volume and function – evaluate volume overload.

Look for associated abnormalities – aortic arch anomalies, aortic coarctation, pulmonary stenosis.

Quantify the shunt (Qp/Qs).

Note: Unlike an ASD, LV stroke volume contributes to the PA forward flow during left to right shunting.

Assess for the presence of aortic regurgitation observed with perimembranous defects.

Fig. 16.1. Schematic drawing showing the categorization used for differentiation of the various types of ventricular septal defect. Viewed from a right ventricular aspect.

Fig. 16.2. b-SSFP images of an inlet VSD (arrow) in a patient with congenitally corrected transposition of the great arteries (a) 4-Ch and (b) SA views.

Fig. 16.3. b-SSFP images of a VSD (arrow) with overriding aorta in a patient with Tetralogy of Fallot (coronal oblique view (a), b coronal oblique view following correction with VSD patch (arrowhead)).
missing or small components

superior vena cava
inferior vena cava
right atrium
left atrium
right ventricle
left ventricle
pulmonary veins
pulmonary artery
aorta
superior vena cava
inferior vena cava
right atrium
left atrium
pulmonary veins
univentricular heart
absent right ventricle
pulmonary artery
aorta
small (hypoplastic) right ventricle
missing or small components
missing or small components

superior vena cava

inferior vena cava

right atrium

left atrium

right ventricle

univentricular heart

absent left ventricle

pulmonary veins

pulmonary artery

aorta
missing or small components

hypoplastic left heart syndrome (HLHS)
small (hypoplastic) left ventricle
abnormal connections

- superior vena cava
- inferior vena cava
- right atrium
- left atrium
- right ventricle
- left ventricle
- pulmonary veins
- pulmonary artery
- aorta
abnormal connections

superior vena cava

inferior vena cava

right atrium

typical right atrium

right ventricle

typical right ventricle

left atrium

left ventricle

pulmonary veins

pulmonary artery

aorta

anomalous pulmonary vein connection (partial)
abnormal connections

superior vena cava

inferior vena cava

pulmonary veins

left atrium

left ventricle

pulmonary artery

aorta

anomalous pulmonary vein connection (total)
abnormal connections

- Superior vena cava
- Inferior vena cava
- Right atrium
- Left atrium
- Right ventricle
- Left ventricle
- Pulmonary veins
- Pulmonary artery
- Aorta
abnormal connections

superior vena cava

inferior vena cava

right atrium

left atrium

right ventricle

left ventricle

aorta

pulmonary arteries

pulmonary veins

transposition of the great arteries (TGA)
we all perceive things differently
cardiologist and surgeon see **different** anatomy

**pre-op** echo

**intra-op** morphology
3-D has helped, and will help more
the ability to correct the many things that can go wrong parallels the length of my life
surgery for congenital heart disease

just one and a half hours of Gresham time

let Gresham history = 12 hours
rolling credits to come
The Heart of the Matter

an introduction to the series

- why congenital heart disease?
- how the heart develops
- what can go wrong with it
- how diagnosis has changed
the heart is **special** to humans

The living body is warm, it breathes and it moves with an innate motion and in reaction to structural changes. Thus *life* must be hot, mobile, associated with breath. It was natural to try and identify a locus for this in the living body.
how the heart develops
the heart is special
the heart is complex
the heart can be malformed
malformations affect physiology
we can now make accurate diagnoses
Global Causes of Child Deaths, 2010

Through synergy with infectious diseases, undernutrition causes 35% of child deaths.
Regional Distribution of Causes of Child Deaths: 2008
the heart is special
the heart is complex
the heart can be malformed
malformations affect physiology
we can now make very accurate diagnoses
the heart of the matter

Martin Elliott

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Professor of Cardiothoracic Surgery at UCL
co-Medical Director at The Great Ormond Street Hospital for Children
Consultant Cardiothoracic Surgeon at The Great Ormond Street Hospital for Children
the heart of the matter

the heart: an introduction
Moind's Fourth Postulate

The degree of certainty in one's level of competence is inversely proportional to the actual level.
abnormal connections

- superior vena cava
- inferior vena cava
- right atrium
- left atrium
- right ventricle
- left ventricle
- pulmonary veins
- pulmonary artery
- aorta
abnormal connections

superior vena cava

inferior vena cava

right atrium

right ventricle

pulmonary veins

inferior vena cava

pulmonary artery

aorta