Absolute Flow Measurements by Thermodilution
First Data with a Novel Catheter

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Absolute Flow Measurements by Thermodilution

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\[ Q = Q_i \times \frac{T_i}{T} \times 1.08 \text{ (mL/min)} \]
What do we need?

- Infusion pump + saline
- Pr-Temp guide wire
- Infusion catheter
- Hyperemria
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\[ Q = Q_i \times \frac{T_i}{T} \times 1.08 \ (mL/min) \]

- New catheter
- Simplification
- Reproducibility in pts
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- **Monorail** infusion catheter with double lumen
- **Inner lumen** to measure the infusion temperature
- **Outer lumen** to infuse saline via side holes
Is the volume \( (Q_i) \) delivered by the pump reliable?

\[
Q = Q_i \times \frac{T_i}{T} \times 1.08 \text{ (mL/min)}
\]

Conclusion: the pump delivers the exact flow
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\[ Q = Q_i \times \frac{T_i}{T} \times 1.08 \text{ (mL/min)} \]

- New catheter
- Simplification
- Reproducibility in pts
Is the temperature ($T_i$) constant for a given pump-flow rate?

$Q = Q_i \times \frac{T_i}{T} \times 1.08 \text{ (mL/min)}$

$T_i$ is not constant and should be measured in each patient
Is there an influence of the distance between infusion catheter and sensor?

Provided the sensor is placed at least 4-8 cm from the perfusion catheter, its exact position does not matter.
Hyperemia

\[ Q = Q_i \times \frac{T_i}{T} \times 1.08 \quad \text{(mL/min)} \]

Only during hyperemia

Is the perfusion of saline itself not a hyperemic stimuli?
Doppler Flow Velocity Measurements

- at rest,
- after 200 μg of IC adenosine,
- during incremental infusion-rates of saline (5, 10, 15, 20 mL/min)
Impaired Coronary Vasodilator Reserve in the Immediate Postcoronary Angioplasty Period: Analysis of Coronary Artery Flow Velocity Indexes and Regional Cardiac Venous Efflux

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The ratio of peak hyperemic/basal mean coronary flow velocity, an index of coronary vasodilator reserve, immediately after coronary angioplasty normalizes in <50% of patients. To evaluate other indexes of coronary vasodilator flow or artery flow velocities, but did result in significantly higher papaverine responses after angioplasty. Mean and phasic coronary velocity, diastolic coronary flow velocity integral and measured great cardiac vein flow ratios were
Doppler Flow Velocity Measurements

- at rest,
- after 200 μg of IC adenosine,
- during incremental infusion-rates of saline (5, 10, 15, 20 mL/min)
Flow Velocity Measurements Adenosine IC
Flow Velocity Measurements

Saline 5 mL/min
Flow Velocity Measurements

Saline 10 mL/min
Flow Velocity Measurements  Saline 15 mL/min
Flow Velocity Measurements  Saline 20 mL/min
Saline induces Maximal Hyperemia
Absolute Flow Measurements by Thermodilution

First Data with a Novel Catheter

\[ Q = Q_i \times \frac{T_i}{T} \times 1.08 \text{ (mL/min)} \]

- New catheter
- Simplification
- Repeatability
Test / Re-Test Repeatability for Flow (mL/min)

Difference vs. average: Bland-Altman of Q (mL/min)
Test / re-test Repeatability for Resistance (mm Hg.min.mL\(^{-1}\))
Conclusions

1. It is possible to measure absolute coronary blood flow and minimal microvascular resistance

2. Time needed is ± 1 minute (5 to 15 minutes all in), good repeatability

3. Intrapatients measurements of microvascular resistance: effect of medications, mechanistic studies of the microvasculature, MI’s, etc, …

Limitations

1. Invasive, room occupied by the catheter,

2. Myocardial mass is unknown

3. Flow and pressure are not measured at the exact same spot