A Comparison of EIT Lung Perfusion Measures

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Why Monitor Lung Perfusion?

• Pulmonary embolisms are notoriously challenging to diagnose and monitor

• Mainly diagnosed using CT pulmonary angiography
  • Associated with radiation exposure and invasive administration of a contrast agent

• Clinical need to improve diagnosis and monitoring
  • Safe and low-cost method with few false positives
Perfusion/Ventilation Monitoring

Perfusion/Ventilation match  Perfusion/Ventilation mismatch

Sample sketches represent ventilation and perfusion in a human thorax.
Ventilation

• Validated and reasonably well understood

Perfusion

• Less understood and validated
Perfusion Monitoring Techniques

Bolus Injection  Ventilation Filtering  Apnoea Filtering
Contrast agent measures of perfusion

- Requires apnoea
- Non-continuous
- Invasive
- Can be performed a limited number of times
- Provides a series of blood flow images
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Experimental Protocol

Baseline  Filling  10 minutes post  2 hours post
Experimental Protocol

- Gas
- Liquid

Baseline
Filling
10 minutes post
2 hours post

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Frequency filtering technique

Time Domain

Frequency Domain

Phase Alignment

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Shortcomings of Pulsatility

• Heart rate is unstable over time

• Many pixels throughout the image are out of phase

• Events at the heart rate frequency are not limited to perfusion
Conclusion

• Many challenges accurately estimating perfusion from pulsatility

• Preliminary analysis shows correlation between the three methods of perfusion measures
  • Comparing both center of mass and overall shape

Bolus Injection  Ventilation Filtering  Apnoea Filtering
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