

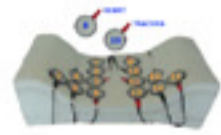
DEVELOPMENT OF CRACKLES DURING SPINAL ANESTHESIA

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BACKGROUND AND PURPOSE

Atelectasis is known to occur during spinal anesthesia and can cause crackles that can be detected by auscultation. Continuous or frequent auscultation can be difficult or impractical. We were interested in determining if automated lung sound analysis could be used to detect abnormal lung sounds during spinal anesthesia.

METHODS



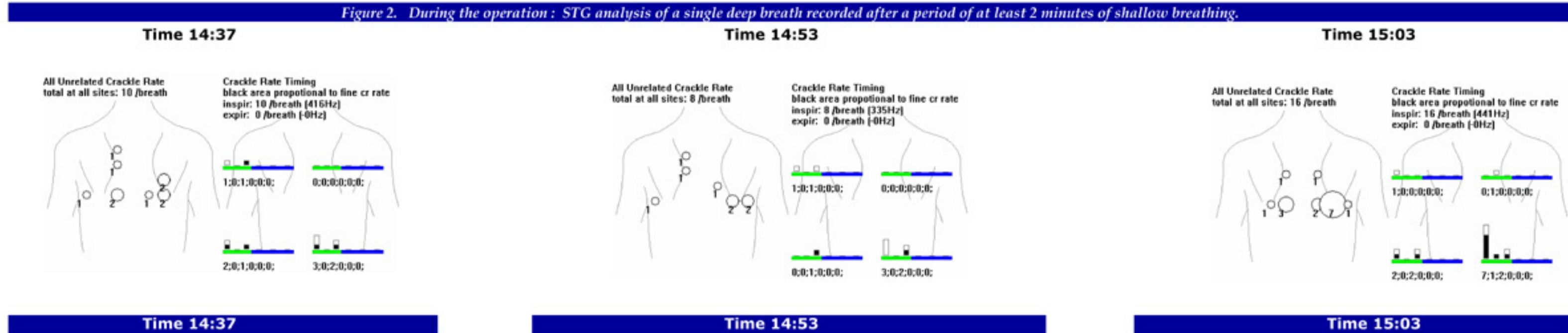
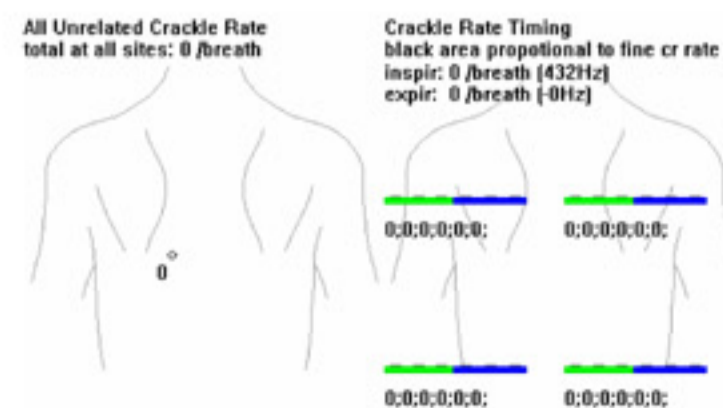
A 16 channel lung sound analyzer (Stethographics Model STG1602) was used to detect acoustic data at 14 sites over the posterior and lateral chest of a 69 year old white male undergoing spinal anesthesia during surgery to remove a hydrocoele. The device has electronic microphones imbedded in stethoscope chest pieces, which are in turn imbedded in soft foam for patient comfort and to reduce ambient noise. The operative procedure lasted 45 minutes.



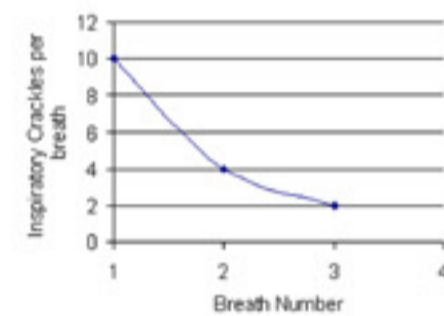
RESULTS

- Prior to the procedure no crackles were detected.
- Fourteen minutes into the operation, fine crackles were detected at most lung sites with accentuation toward lung bases, particularly at the right base.
- At least 8 inspiratory crackles were identified in the first deep breath following the periods of shallow breathing.
- In 6 recordings separated by at least 2 minutes the STG identified 11 ± 4 (mean \pm SD) inspiratory crackles, range 8 to 17.
- In every recording after the patient took 3 deep breaths, the crackle count returned to zero.

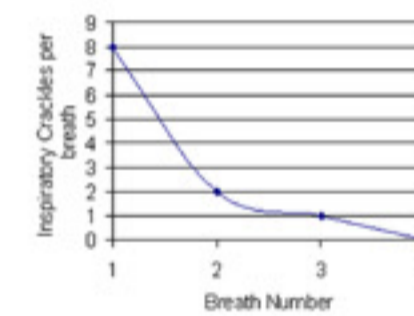
Figure 1. Normal breath prior to procedure



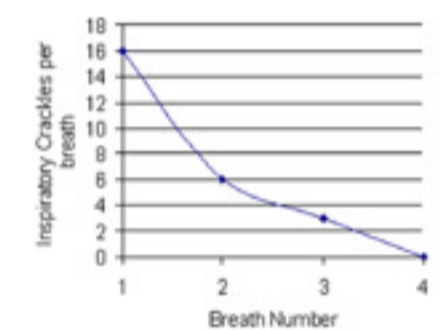
Series of deep breaths following a period of shallow breathing



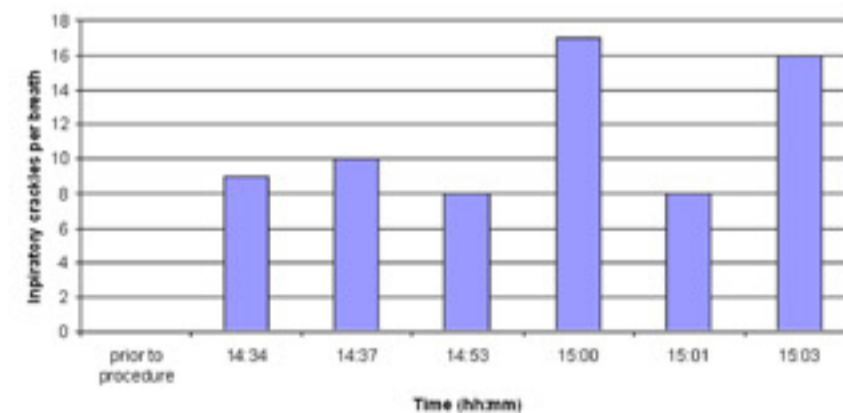
Series of deep breaths following a period of shallow breathing



Series of deep breaths following a period of shallow breathing

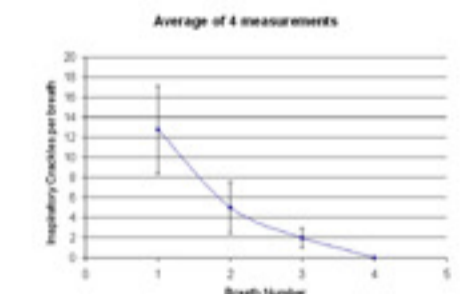
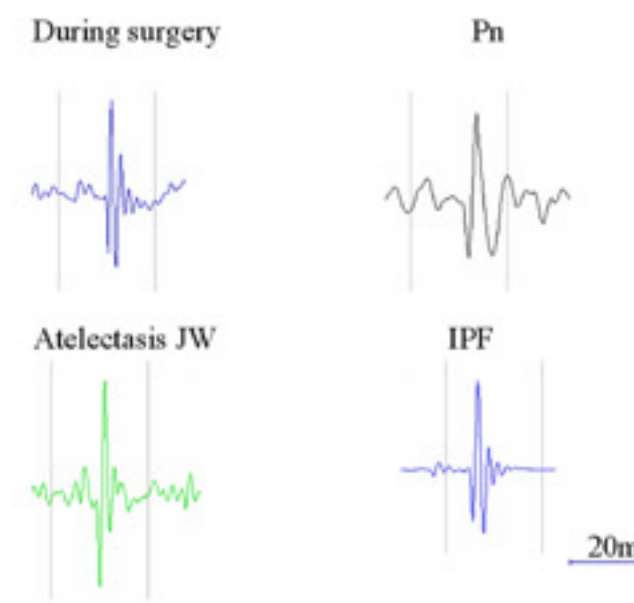


Number of inspiratory crackles identified during a deep breath following a period of shallow breathing.



In 6 recordings separated by at least 2 minutes, the STG identified 11 ± 4 (mean \pm SD) inspiratory crackles, range 8 to 17.

Time expanded waveform analysis of the crackles of this patient and typical examples of crackles of a patients with pneumonia (PN), atelectasis and interstitial pulmonary fibrosis (IPF).



In every recording after the patient took 3 deep breaths, the crackle count returned to zero.

CONCLUSION

- The crackle waveform characteristics and the disappearance of the crackles on deep breathing are consistent with atelectasis as their cause.
- This presumptive finding of atelectasis would otherwise not have been detected.