# REDUCTION OF NOISE IN ELECTROMYOGRAM OF RESPIRATORY MUSCLES

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## Introduction

The electromyographic signal (EMG) has been widely used in intensive care units for evaluation of neuromuscular activity of respiratory muscles because it gives essential information to predict the respiratory state of fatigue. To obtain reliable data, the signal has be cleaned of noises and more particularly electrocardiogram artefacts (ECG).

In such conditions the quality of EMG signal is essential and depends on the correct positioning of needle electrodes and probes; movements artefacts (tremor, cough, vibrations, shocks) or electrical perturbations such as ECG can also interfere. The aim of this study was to compare the effect of three different data treatment, wavelets multi-resolution (WAV) wavelets lifting (WLI) and mathematical morphological (MMO) techniques, on the noise reduction of diaphragmatic electromyogram signal (Edi).

## Material and Methods

Raw EMG (Edi) was sampled (Figure 1: Processing interface sensors, 12 bits data acquisition, 2 kHz sampling rate per channel) using an oesophageal probe on 6 healthy volunteers (age: 20-30 years) also taking part in an other study. Algorithms of the different data treatment of Edi were developed under Matlab© R2009b.

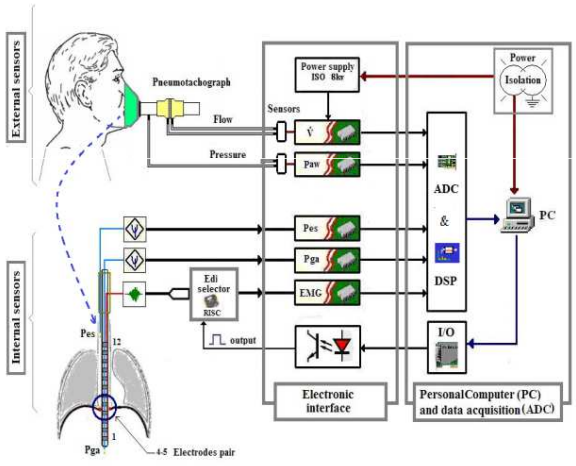


**Figure1:** *Processing interface sensors*

## Results

Figure 2 shows typical noise reductions of the original signal Edi (a panel) obtained by WAV (b), WLI (c) and MMO (d) compared to Edi (a). The reduction of ECG is clearly seen in WAV and with less extension in WLI and MMO. The noise reduction, estimated by ratio = $|s|^2/|n|^2$, (s=signal Edi, n=noises background and ECG), was 1.15, 0.90 and 0.88 for respectively WAV, WLI and MMO.

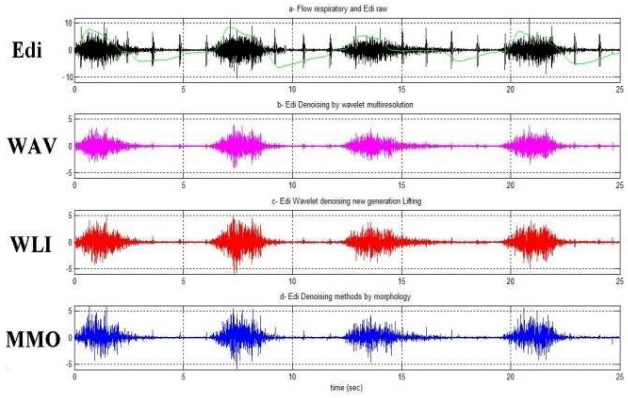


**Figure 2:** *Results of three methods*

## Discussion and Conclusion

It is noted that the three methods are effective, but the decomposition in wavelets multi-resolution is better than the two other methods. Therefore the comparison and use of such methods are crucial for clinical applications like for monitoring of respiratory muscle in intensive care units. These techniques could be also applied in other clinical domains like in childbirth monitoring (uterine EMG), urology (enuresis), muscular diseases (myopathy, dystrophy, myasthenia), rehabilitation, and sport medicine.