Assessment of the benefit of hypnosis in reducing 4DCT scan artifacts: preliminary results from the Hypno-4D trial / Évaluation du bénéfice de l'hypnose dans la réduction des artefacts des scanners 4DCT : résultats préliminaires de l'essai Hypno-4D

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Résumé

Introduction:

For lung stereotactic body radiotherapy (SBRT) under free breathing, 4DCT imaging is mandatory for treatment planning. Irregular breathing can cause severe image artifacts, affecting tumor volume accuracy, normal lung exposure, and even local control (1,2). Audio-visual respiratory coaching exist to regularize breathing but require additional and costly devices. At our institution, hypnosis in radiotherapy is well established to relax some anxious patients and children. Furthermore, some studies have shown that listening to a hypnotic recording can regulate breathing rate and amplitude, even sometimes reducing respiratory motion amplitude.

Since February 2026, we are conducting a single center prospective clinical trial, "Hypno-4D", which objective is to evaluate the potential benefit of a hypnotic recording in reducing artifacts during 4DCT acquisition for lung SBRT.

Materials and Methods:

A total of 25 patients are planned to be enrolled. Two consecutive 4DCT acquisitions, first in free breathing (FB) and second under hypnosis, are performed (2 mm slice thickness). Respiratory motion is monitored using surface imaging for retrospective reconstruction into ten phase bins. Scan parameters are adjusted according to the observed breathing pattern. After the first scan, patients undergo a 5-minute hypnotic induction via an audio recording developed by a certified hypnotherapist, then a second 4DCT is acquired (H1). For reproducibility study, a 4DCT under hypnosis (H2) is performed at patient first session. Artifacts

*Intervenant

at the patient surface, diaphragm, and tumor are estimated by double visual verification using MIM software and an automated algorithm. Breathing signals are analyzed using a dedicated Python program: respiratory frequency, cycle-to-cycle variability, peak-to-peak amplitude, and RMS amplitude were extracted as regularity criteria.

Results:

Preliminary results on 8 patients (fig 1) showed a reduction in 4DCT artifacts after hypnotic induction. Visual assessment revealed a smaller mean artifact number on diaphragm under hypnosis (CTH1: 2.6 vs. FB: 3.0) and surface artifacts (CTH1: 4.1 vs. FB: 4.7). Breathing signal analysis showed a higher mean respiratory frequency under hypnosis (CTH1: 15.5 bpm vs. FB: 13.0 bpm) alongside a reduction in mean amplitude (CTH1: 7.6 mm vs. FB: 9.7 mm), suggesting improved breathing regularity (fig 2). Mean Normalized cross correlation (r) across both hypnotic acquisitions was 0.83, reflecting good inter-cycle shape consistency. Automated artifact detection sensitivity is currently being optimized.

Conclusion:

Primary findings showed that hypnosis can regularize breathing during 4DCT, potentially reducing artifacts. As a simple, low-cost, non-invasive approach, it could help improving target delineation, pending confirmation on the full patient cohort.

References:

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Mots-Clés: 4DCT, Hypnosis, Respiratory artifacts, Lung SBRT