curac2004
3. Jahrestagung der Deutschen Gesellschaft für Computer- und Roboterassistierte Chirurgie e.V.

Localization of lung tumours for navigated radiotherapy

Localization of lung tumours for navigated radiotherapy

Vences-Salcedo Lucia[1], Otto Sauer[2], Kajetan Berlinger[3]

[1]Klinik und Poliklinik für Strahlentherapie Universität Würzburg
[2]Klinik und Poliklinik für Strahlentherapie, Universität Würzburg
[3]Bildverstehen und Wissenbasierte System, TU München

Introduction

In [1, 2] we have presented a software to control tumour position just before a radiotherapy session takes place. The system we presented compares tumour information in the planning 3D CT and the therapy 3D CT. Through a rigid registration between both volumes the Interfractional movement is identified. In the case of lung tumours, the respiratory movement can displace a tumour in the order of one centimetre. This means that it is not enough to verify patient position on treatment couch, but the radiotherapy has to take into account the intrafractional movement as well. Some authors have tried to control this movement by controlling the patient's respiration [3, 4]. In this work we used another approach.

Methods and materials

We captured tumour intrafractional motion during free respiration. We used the results from the 3D-3D rigid registration to localize the longitudinal position where the tumour was found. In this fix position several transversal slices are achieved a long 15 seconds. Ordering these slices chronologically and comparing them with the 3D treatment CT we can calculate and even have a 3D reconstruction of tumour displacements during a respiration cycle.

Results

We have tested this application with data from 4 different lung patients and a total of 8 studies and compared our results with the results of an expert. Taking into account the respiratory movement we reduced the discrepancy between our results and experts coordinates in +/-3mm. As there is no gold standard for this problem, it is difficult to establish absolute errors.

Discussion

We are aware, that our results are not yet conclusive, but they are encouraging. We are looking forward to testing with a wider population.

An important requirement for our software was to be interactive. We used a rigid body model as a compromise between accuracy and response time.

Our goal is the navigated radiotherapy. Observing the respiratory movement, we want to infer tumor's position from the respiratory state. To establish a correlation between respiratory state and tumor position we are examining non rigid deformable methods and we plan a 4D CT model.

1. L. Vences, O. Sauer, M. Roth, K. Berlinger, M. Doetter, A. Schweikard,Local Rigid Registration: A tumour localization application. On: The XIVth International Conference of the Use of Computers in Radiation Therapy. Seoul, Korea, May, 2004 pp. 612-614. Editors Byong Yong Yi, Seung Do AHN, Eun Kyung CHOI, Sung W.HA
2. L. Vences, O. Sauer, M. Roth, K. Berlinger, M. Doetter, A. Schweikard.Localisation of moving targets for navigated radiotherapy Scientific Workshop Medical Robots, Navigation and Simulation, MRNV 2004, RheinAhr Campus, Remagen, Germany, March, 2004
3. Remouchamps VM, Letts N, Yan D, Vicini FA, Moreau M, Zielinski JA, Liang J, Kestin LL, Martinez AA, Wong JW. Three-dimensional evaluation of intra- and interfraction immobilization of lung and chest wall using active breathing control: a reproducibility study with breast cancer patients. Int J Radiat Oncol Biol Phys. 2003 Nov 15;57(4):968-78.
4. Cheung PC, Sixel KE, Tirona R, Ung YC. Reproducibility of lung tumor position and reduction of lung mass within the planning target volume using active breathing control (ABC) Int J Radiat Oncol Biol Phys. 2003 Dec 1;57(5):1437-42.