

Semi-Automated Analysis of Standard Uptake Values in Serial PET/CT Studies in Patients with Lung Cancer and Lymphoma

John Ly¹, Lars Edenbrandt^{1, 2}, Sabine Garpered¹, Eskil Jönsson¹, Sven Valind¹

¹Dept. of Clinical Sciences, Skåne University Hospital, Malmö, Sweden

²Dept. of Molecular and Clinical Medicine, Sahlgrenska University Hospital, Gothenburg, Sweden

Objectives

Changes in maximum standard uptake values (SUV_{max}) in PET/CT follow-up studies in oncologic patients is gaining importance in determining disease progression or regression. Manual measurement of these changes can be time consuming. A semi-automatic method for calculation of SUV_{max} in serial PET/CT studies was developed to address this issue.

Method

The program automatically aligns the serial PET/CT studies based on the CT images. A ROI is defined in the PET image of the first or second study and the pathological site is automatically delineated and SUV_{max} is calculated in both studies.

Patients with lung cancer and lymphoma who had undergone two PET/CT studies between July 2008 and January 2010 were included. Pathological sites with sharp contrast to surrounding areas and with no formation of a large conglomerate mass were selected. 16 patients (69% men, age 56 ± 15 (mean \pm SD)) with 26 lesions were included. Each patient had one to four pathological sites.

Three readers (two attendings and one junior physician) did manual and semi-automatic measurements of SUV_{max} on 26 pathological sites in both studies. The difference of SUV_{max} for each uptake was calculated with both measurement methods and tested for agreement using Bland-Altman analysis. Intra class correlations (ICC) between readers' measurements were tested. Time to measure SUV_{max} was recorded for both methods.

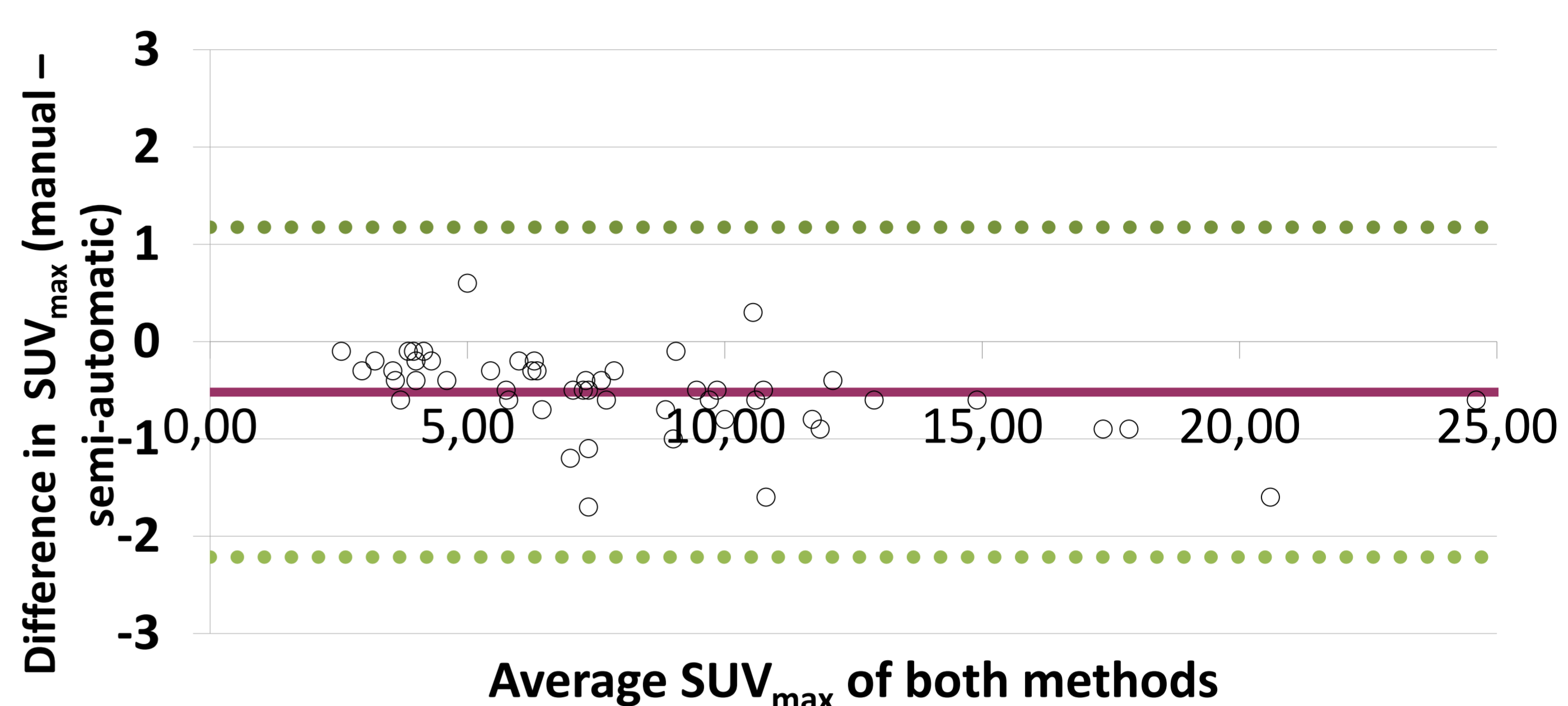
Results

Bland-Altman's 95% limits of agreement between semi-automatic and manual methods were within an acceptable range (reader 1: -3.2 – 1.8; reader 2: -3.4 – 2.3; reader 3, -2.2 – 1.2). The ICCs showed near-perfect correlation in both first (1.00, 1.00) and second (0.94, 0.95) study using semi-automatic and manual method respectively.

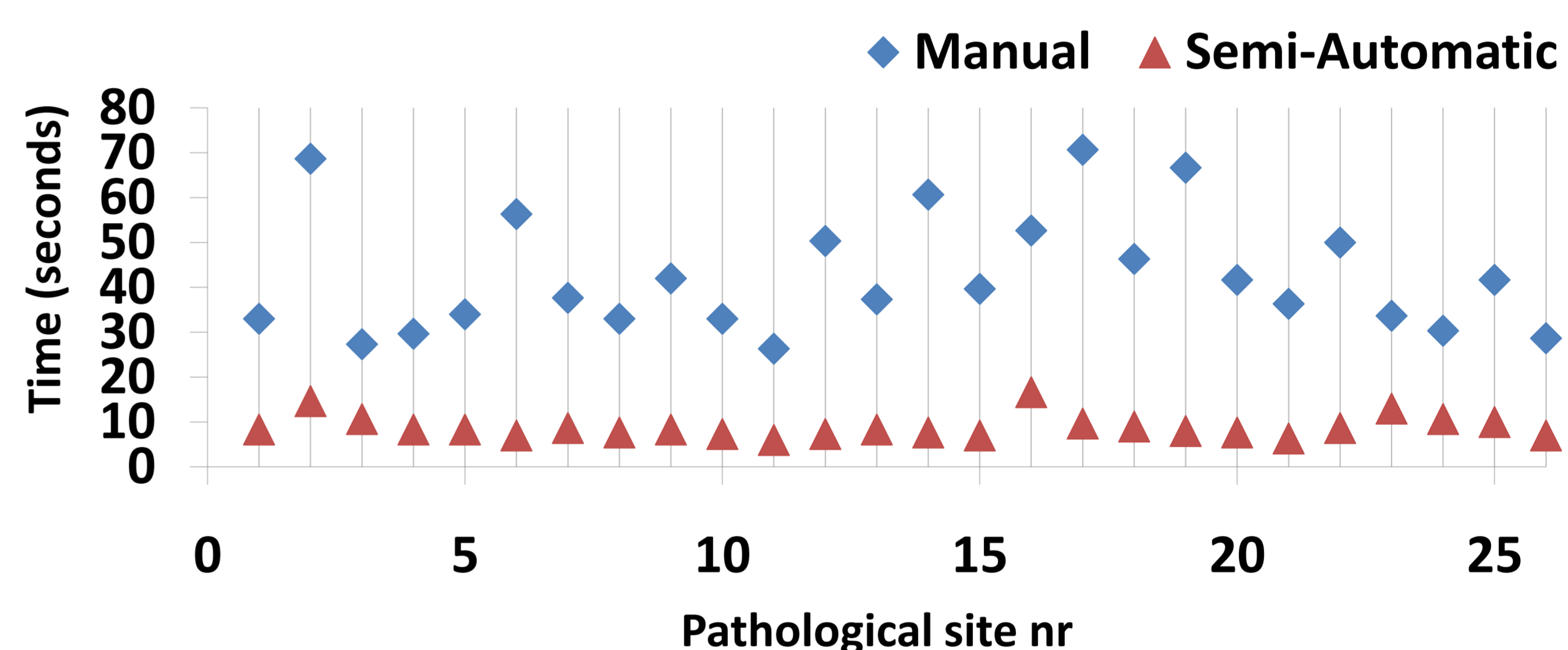
Both methods agreed in all cases whether SUV_{max} had increased or decreased between serial studies. The average time to measure SUV_{max} in first and second study between 3 readers was 8.9s for the semi-automatic method and 42.6s for the manual method.

Conclusions

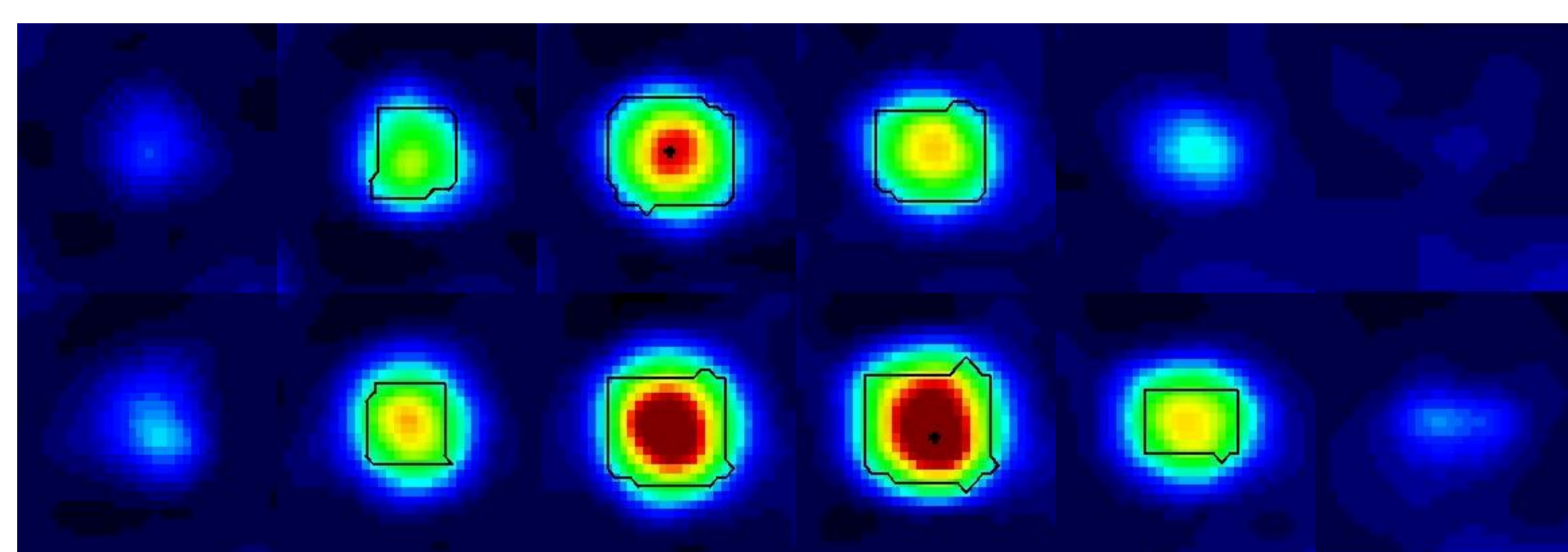
High correlation was showed in absolute SUV_{max} measurements and good agreement in the difference in SUV_{max} between studies. The program shows systematically higher SUV_{max} compared with the manual method. This may be due to different filter settings between the PET/CT manufacturer and the program. The findings show feasibility of using semi-automated calculation of SUV_{max} in serial studies and encourage further development of programs using this type of method.



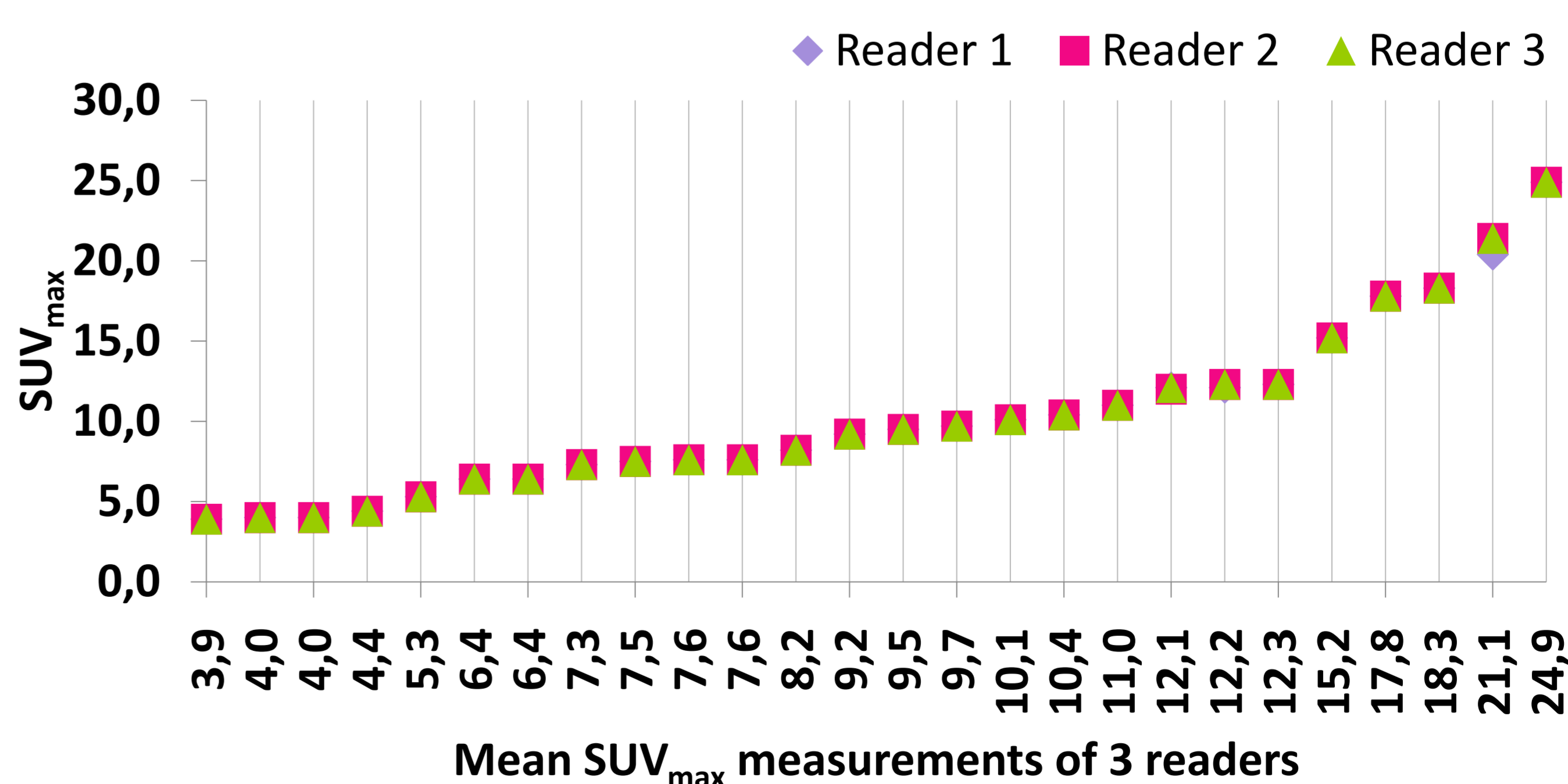
Bland Altman plot showing the agreement between SUV_{max} measurements using semi-automatic and manual methods of reader 3.



Average time needed to measure SUV_{max} by the three readers.



Semi-automatic segmentation of a pathological site in first study (top row) and second study (bottom row). SUV_{max} indicated as a black dot.



Intraclass correlation between all three readers for the semi-automatic method was 1.00, i.e. near-perfect correlation.