CT and MRI are used to image patients' anatomy and disease that lead to deviation from normal anatomy. Small brain lesions were selected as the topic of the doctoral thesis under review. Its title suggests rather clinical work. The reality is that results of CT and MRI are compared between a cohort of ill characterized patients whose CT results were not sufficient for diagnosis and additional MRI exam was required. Additionally, the follow-up MRI was performed no longer than 45 days after the initial CT scan. It raises concerns about potential expansion of active lesions in multiple sclerosis patients. The aims of this work are not clearly stated, nor are there any hypotheses provided. The Results section gives impression that the doctoral student attempted to analyze the data without a clearly stated goal. A quick search of Pubmed reveals that comparisons between MRI and CT were already performed in the late eighties of the last century. They were always restricted to a well-defined condition. In the reviewer's view, this work should be also constrained to well-defined conditions or its results will be very hard to interpret. Furthermore, previous studies comparing MRI and CT should be described in the introductory section to help explain how the current study adds to the knowledge.

The dissertation consists of six main chapters and an abstract. The figures and tables are listed in the beginning; however abbreviations and symbols are not introduced. This thesis is written on 99 pages. It is enriched by 17 tables, eight figures, and 65 references.

The abstract is relatively long. However, it does not provide an overview of the dissertation, nor explain the major goals of it. Instead, it provides trivial information on central nervous system (CNS). It is followed by the statement of the aim, i.e., comparison of detection effectiveness of small lesions. It is not clear what the author understands as detection effectiveness. This term is too general and it should be replaced by specific hypotheses. Data analysis methodology should be selected to evaluate these hypotheses and described in detail. Description of methodology should be included in the Material and Methods section, not in the Results.

The first chapter INTRODUCTION includes basic information on disorders leading to CNS lesions and imaging techniques. The former part, besides basic information, contains descriptions of various conditions that may lead to lesion formation in the brain. Some of these disease do not come up in diagnoses of patients, whose data are used in this study. In the reviewer's view, the scope of the study should be limited to well-defined disease states or types of lesions. The description should be limited to the disease states or types of lesions that are topic of the dissertation.
The latter part of the chapter concerns imaging techniques. Although CT techniques are relatively well described, it is not clear why “other” imaging methods including PET, SPECT, and NIRS are included. They are not part of the work and should be left out. Unfortunately there are multiple errors and omissions in the description of MRI. To name a few:

- The magnitude of Earth’s magnetic field does not exceed 65μT (source: Wikipedia), the magnetic field of a 3T scanner is thus 50 thousand times stronger than magnetic field of the Earth (not about 1000-fold).
- Nuclear magnetic resonance is physical phenomenon in which nuclei absorb and re-emit electromagnetic radiation; this changes the magnetic properties of investigated object. In medicine, only hydrogen protons (or magnetic moments associated with them) are used for imaging. The electromagnetic radiation changes their magnetic properties. These properties are associated with spin magnetic moments, not rotations of the proton itself. Spin is an intrinsic form of angular momentum carried by elementary particles, such as electrons and protons.
- Volume of Interest (VOI) is a term used in magnetic resonance spectroscopy. The author probably means a voxel.
- The mechanisms behind contrasts in T1-weighted, T2-weighted and FLAIR images are longitudinal and transverse relaxation. TR and TE do not affect the mechanism, but they affect the appearance (so called contrast) of the resulting image.

In general, it would be advisable to completely rewrite the chapter using a book description as an example. The current description suggests that not much thought was put in describing MRI.

Second chapter states the aim of the study in one sentence. This chapter should be on a separate page.

Third chapter describes the studied cohort, as well as MRI and CT protocols. Unfortunately patients’ selection criteria are not stated. The motivation behind establishing such patients’ groups is missing. What was the reason for including the very inhomogeneous group A2? There is no mention of appropriate bioethical committee agreement to conduct the study. If such agreement was not necessary, appropriate explanation should be provided. Finally, selection of all statistical tests should be explained. Why RIR Tukey test was used to compare signal intensities?

The methods chapter should include criteria of selecting lesions on CT.

Last but not least, the introduced measures raise concern. In contrast to CT, the absolute signal intensity in MRI images is meaningless. It simply represents the setup of the MRI amplifier: the receiver gain is automatically adjusted to use the full dynamic range (intensities) of the resulting image. Furthermore, was the mean, median or maximum intensity of the lesion selected for analyses? This parameter should be specified. Also the assumption that all lesions resemble circles (p. 65) is at least questionable, given the multitude of shapes described in Table 1 till Table 4.

Thus, only the numbers of small lesions and respective ratios remain.

Chapter IV describes the results. I will not comment on the results where I questioned methodology. The fact that more lesions are visible in FLAIR than in T2 is due to attenuation of fluid signal in the FLAIR sequence. In Table 9 (page 70) the ratios of lesion sizes were not calculated in some cases; the reason for not performing the calculation should be provided. An interesting finding is that CT is more sensitive to detect some kinds of lesions. Description of statistical analyses should be part of the methods section. Only results should be described in chapter IV.
The fifth chapter contains discussion. It should start from short summary of the results, followed by comparison with earlier studies; these studies should have been already described in Introduction. On page 91 the author cites a study comparing sensitivity of MRI and CT in detecting lesions. Would it not be advisable to provide similar kind of results in the current study? Especially, given that the title of the dissertation implies comparing usefulness/sensitivity/specificity of MRI and CT in detecting lesions.

The conclusions, included in chapter VI, are only partially supported by the results. The first point in this section was not evaluated in the dissertation. Neither usefulness of T1 weighted images was. Third conclusion is standard clinical practice not related to analyses done in the dissertation. The same applies to the first part of second conclusion.

Given the weight of the critiques above, I do not believe that the requirements concerning Ph.D. thesis defined by Polish law have been fulfilled and I do not recommend to admit Mr. Raaid T. Jousif al Tarrawi to public defense of this thesis.