UNIWERSYTET MEDYCZNY IM. KAROLA MARCINKOWSKIEGO W POZNANIU

KLINIKA CHORÓB KRĘGOSŁUPA I ORTOPEDII DZIECIĘCEJ

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Poznań, 04.03.2019

Szanowna Pani
Prof. dr hab. Magdalena Krajewska
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we Wrocławiu

Wielce Szanowna Pani Dziekan,

Zapoznałem się z poprawioną rozprawą doktorską lek. Carstena Kantelberga pod tytułem „Wpływ wyników analizy morfometrycznej nasady łuków kręgosłupa szyjnego na technikę operacyjną", „Morphometric analysis of the cervical pedicles and Conclusions for posteriori cervical instrumentations" i stwierdzam, że zgłoszone przeze mnie uwagi i zastrzeżenia zostały uwzględnione w stopniu zadowalającym.

W tej sytuacji dostrzeżone w tekście błędy literowe oraz drobne uchybienia formalne (np. określenie tabel mianem rycin, s.42 – 45) nie negują wartości pracy, która, w mojej opinii, może być skierowana do dalszych etapów przewodu doktorskiego.

Z wyrazami szacunku

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Review of the thesis
„Morphometric analysis of the cervical pedicles and conclusions for posterior cervical instrumentation"
by Carsten Kantelberg

With many interest I have read the thesis by Carsten Kantelberg.
The topic is both interesting and important from the clinical point of view. Detailed knowledge of the anatomy of vertebrae stays a crucial factor for the safe placement of spinal implants. Within the cervical region of the spine any imperfect screw placement can result in the damage to the spinal cord, vertebral artery or other vulnerable cervical structures. This is why the topic of the thesis can be assessed as a well-chosen and a valuable one.
Below, the reviewer provides a detailed analysis of the scientific aspect of the thesis.
The underlined fragments of this review require to be addressed by the Author of the thesis. The corrections and improvements introduced into the manuscript should be presented at the attention of the commission at Wrocław University of Medical Sciences.

Title page:
doctoral degree in medicine (not in "human medicine") is the proper academic degree delivered at Polish faculties.

Chapter 1. Introduction:
It is advantageous to present a historical perspective of the problem approached in the doctoral thesis. Thus, the idea of the Chapter 1.1. „History of spinal treatment" is to be supported. However, the current form of this chapter needs some improvements. There exists a huge divergence between the well described ancient era, middle age or renaissance versus quite poor description of the modern contemporary achievements in the domain. The latter is presented by the Author in a short and rather superficial way. For example, a nice chapter about Ludwig Guttmann (page 7) is followed by a big time gap extending from the after the World War II till nowadays. The 50-year period between the Guttmann story and the 1990s methylprednisolone use deserves description.
A specific comment: What do the three stars stand for (page 2, line 12) ?
Chapter 1.2. History of instrumented spinal treatment
In this chapter the Author provides an interesting review of the achievements in the field of spinal instrumentation. This review tends to be comprehensive. However, there are eminent names missing: Luque for double rod fixation using sublaminar wires, Roy-Camille for being the first to introduce pedicle screws, Zielke – a German orthopedic surgeon who largely improved anterior instrumentation by replacing the flexible cable initially proposed by Dwyer with a rigid threatened anterior rod, Lenke – the inventor of the technique the most frequently used nowadays, comprising true 3D deformity correction due to apical derotation, McCarthy for the growing rod construct, Campbell for the vertebral expandable rib construct, Cheung for magnetic expandable rod construct and others. The construction of the frame (page 10) was used far before the USS system, namely by Cotrel and Dubousset for the first time.

Chapter 2. Anatomy of the spine.
Description of the anatomy of the spine is comprehensive. The bony and soft tissue structures are named and shortly characterized. A few figures are provided.
Nevertheless, this reviewer is unable to approve the chapter in its current form. First, it is unnecessarily long for the topic of the thesis. The anatomy chapter occupies 20 pages which means ¼ of the whole text of the thesis comprising totally 80 pages. Second, the anatomy chapter is written in an old fashioned manner, typical for XX century textbooks of descriptive anatomy. The topic of the thesis would require more functional and more topographical description of the anatomy. Correct placement of pedicular screws within cervical vertebrae is primarily determined by the specific relations of the bony structures to the soft tissue structures. This aspect is not sufficiently considered. The cervical spine anatomical specificity is hardly mentioned. Third, the pages 20 through 24 comprise multiple citations, after each short sub-chapter, which raises question about the originality of this part. Last, the anatomy chapter contains nine figures (Fig 1-Fig 9). These figures were certainly not created by the Author of the thesis, they are probably reproduced from various anatomy textbooks, unfortunately, no reference is provided.

Chapter 3. Aim of the work.
In this chapter the Author carefully avoids naming any aim of his work. The Author writes: "The aim of this work is to draw conclusions about posterior cervical instrumentation based on the data obtained in Chapter 3 (sic!), taking into consideration the relevant literature on the subject. For this purpose, the morphometric data of all that are relevant to the work within a certain period by CT detected spines were evaluated and processed in the light of the objective of this document".
For the reviewer, this is quite an obscure fragment of the text. No aim is directly named. The aim should be clearly defined. "To draw conclusions about" cannot be the aim.

Chapter 4. Materials and methods.
In this chapter the Author advocates the advantages of the CT machine used: "the world's fastest", "extremely high resolution", "one of the best devices of its kind", "allowed for completely new diagnostic approaches", "extremely accurate images can be generated", "excellent image sharpness", "extremely useful and accurate" etc.
This part of the text looks like a copy of the producer's advertisement. The author should concentrate on technical data and avoid emotional expressions which have no place in a scientific work.

Chapter 4.2. Patients
The author studied the sample of 123 patients which is a sufficient number. The C2 through C7 vertebrae were studied and not the C1. The exclusion criteria needs correction: the missing "not" (page 36, line 9). What was the population studied ? Was it Middle European by ethnicity or was it a mixed population ? This question is valid according to the literature data underlying differences in vertebral morphology by ethnicity (Yousof et al. 2006 – page 52) and according to the author's finding of the bigger pedicles in the sample studied comparing to the literature data (page 75).
Description of the methodology of taking the measurements is certainly the weakest part of the thesis. Why the author did not check for intra-observer agreement, for example using the ICC calculation ? Why he did not check for inter-observer agreement ? Why the author did not calculate his own measurement error ? What was the rationale to re-measure all the

parameters ? (page 37, line 6) and was the final value calculated as the mean of the two measurements ?
The answer should be provided by the author at least about the intra and interobserver agreement of the measurements.

Chapter 5. Measured distances and angles.
The parameters are defined and drawn at figures in a correct manner.
Four parameters were measured by the Author. They all are crucial for pedicle screw placement.

Chapter 6. Results.
The results are correctly presented in tables, partly in the main body of manuscript and partly in appendices.
The author should pay attention to correct the German into the English wording in Figures 15, 16, 17 and 18.
The calculation of the mean and of the standard deviation are provided in tables. The numbers have as many as three up to six digits after the coma which is unnecessary taking into consideration the measurement error and this should be unified throughout the tables.
There are four tables in the Result section however, they lack either numbers, titles, legends and the reference within the body of the text.
It is a pity, the author did not try to enhance his research, for example by calculating correlations between the parameters or the differences between the spinal levels.

Chapter 7. Discussion.
This is the strongest part of the thesis. The author provides very nice review of published literature. He proves his knowledge of the problem. The discussion is interesting, comprehensive and contributes a lot to the final positive assessment of the thesis.
There are figures missing (Figure 19 through 22), just the legends were printed out.

Chapter 8. Conclusion.
90% of the conclusion chapter is the author's opinion summarizing the discussion chapter. The last two sentences are the real scientific conclusions of the thesis. These scientific conclusions are correctly written.

Literature
The number and the spectrum of the scientific papers are correct.
Neither the Vancouver not the Harvard system is fully respected. Please, review for unifying the citation system.

In summary, the work by Mr. Carsten Kantelberg may be considered for obtaining the university degree of doctor in medicine under condition that the indicated corrections and improvements are made and inserted in the manuscript. Then, the changes of the manuscript should be presented at the attention of the commission of the university.
As the reviewer, I approve that the doctoral procedure can be continued at Wrocław University of Medical Sciences.

Poznań, 30.09.2018

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