PROPER COLLIMATION EFFECT ON RADIATION DOSE AND IMAGE QUALITY IN THORACIC SPINE RADIOGRAPHY

by

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The purpose of this research was to determine the impact of collimation in thoracic spine radiography on patient exposure and image quality. The study was performed on 84 patients referred to thoracic spine radiography. Patients were randomly divided into two equal groups of 42. The first group was imaged according to the standard collimation protocol used in one of the hospitals in Croatia while the second group was imaged by applying "optimal" collimation, image field size was individually collimated for each patient or according to the greatest image field collimation depicted in professional literature. For each patient body mass index, image field size, exposure conditions and dose area product were noted and absorbed doses by organs were calculated, image quality was assessed. There were no statistically significant differences in BMI between the two groups of patients. With the optimal collimation the size of the imaging field in the anteroposterior projection was reduced by 45 % ($p < 0.001$) and in the lateral projection by 41 % ($p < 0.001$). The study also showed reduced values of DAP for anteroposterior projection by 34 % ($p = 0.007$) and for lateral projection by 23 % ($p = 0.040$). The mean absorbed dose to the selected organs decreased by 26 % in the anteroposterior projection and by 28 % in the lateral projection. In addition, the optimal collimation protocol improved image quality by 13 % in anteroposterior projection. No differences in image quality were found in lateral projection. By carrying out this research we have demonstrated that optimal collimation in thoracic spine imaging has a strong influence on patient exposure to radiation and has a positive impact on image quality.

Key words: thoracic spine radiography, collimation, dose reduction, image quality

INTRODUCTION

The European Commission publication [1, 2] on the exposure of European population to radiological procedures reports that general radiography examinations are the most common in all countries (76.8 to 97 %), followed by computed tomography (CT) (0.7 up to 16.7 %), fluoroscopy (0.9 to 13.9 %) and interventional radiology (from 0.03 to 2.7 %). The most common procedures in general radiography are those of the chest/thorax, cervical spine, thoracic spine, lumbar spine, mammography, abdomen and pelvis and hip [1, 3, 4].

In general radiography, thoracic spine imaging is one of the seven procedures with the highest effective dose. The highest effective dose in plain radiography is obtained during lumbar spine radiography (0.898 mSv), followed by pelvis and hip imaging (0.709 mSv) and thoracic spine imaging (0.636 mSv) [1].

Since the most sensitive organs with the highest tissue weighting factor (0.12), such as breasts, lungs, colon, stomach and bone marrow [5], are or may be affected by the primary beam during thoracic spine radiography, it is necessary to ensure an adequate image with the lowest possible exposure of the patient. To put it briefly, it is necessary to apply the as low as lowest reasonably achievable (ALARA) principle [5].

A collimator is a device that limits the radiation output of an X-ray machine to the narrowest possible size based on the imaging area and referral diagnosis [5]. Collimation has direct effect on the volume of the patient's body exposed to the primary beam of ionizing radiation since the beam is formed by proper positioning of collimator blades [6]. Since the volume of irradiation of the patient is reduced by applying accurate and tight collimation, less scatter radiation is produced which improves image quality (IQ). By reducing the size of the primary beam, the dose received by the patient can also be reduced [7]. Thus, if poor collimation is present, the irradiated area is enlarged resulting in dose increase and more scatter, which negatively affects IQ [8].

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Therefore, knowing and applying the central ray and collimation for each individual examination is of great importance [9]. In clinical setting, as already noted, there is a lack of guidelines on proper use of collimation. Karami and Zabihzadeh [7] did a research in the area of lumbar spine radiography and found very poor collimation practice on a sample of 830 radiographs of lumbar spine in anteroposterior projection. Precisely, the image field size was 1.26 times larger than the optimal and consequently, the most sensitive organs (colon, breast, gonads) were near or directly within the primary beam without justification. It caused higher doses for patients, harmful health effects and lower IQ. No similar research in the reviewed literature was found for thoracic spine.

This study aims to discover the impact of collimation on radiation dose (DAP and organ absorbed dose) and IQ in thoracic spine radiography.

MATERIALS AND METHODS

This research was a prospective study using an experimental approach. The study was conducted in two phases on 84 patients (70 female and 14 male) referred to thoracic spine radiography in two projections (anteroposterior – AP and lateral – LAT), who were randomly divided into two groups of 42 patients each. The patient sample size was calculated using G*power 3.1 analysis tool based on the preliminary data of 20 patients.

The study was conducted due to the discovery that the hospital's *standard* collimation protocol was not in accordance with professional literature. The *standard* collimation protocol was not strictly determined and adapted individually to each patient. In most cases the ALARA principle was not considered when it came to collimation and the image field size quite often remained the same as the size determined by the X-ray system. The primary beam was not collimated properly, and the patients were believed to be over-irradiated during projection radiography of thoracic spine.

In the first phase, 42 patients were imaged in both projections according to the *standard* collimation protocol used in the hospital while in the second phase, 42 patients were imaged with the so called *optimal* collimation protocol mentioned in the professional literature [6, 9]. Each patient was placed in supine position on the examination table in the AP projection and on the left side in the LAT projection. In the AP projection the vertical part of the central ray was positioned to the midline of the body and the horizontal ray in the middle of the sternum. The field size was supposed to be collimated approximately to the width of the thoracic vertebrae (12 cm). In the LAT projection the vertical plane of the central ray was positioned 6-8 cm anteriorly from the posterior (back) border of the patient and the horizontal plane at the same height as in the AP projection. Vertically, the primary beam was supposed to be collimated so that it included the rib cage and horizontally to the posterior (skin) border of the back [6]. The maximum size of the optimally collimated field was 18 cm × 43 cm, if possible [10]. An example of optimal collimation in AP and LAT projection are presented on a sample fig. 1 of an anthropomorphic phantom.

All patients' heights and weights were measured and recorded in order to calculate their body mass index (BMI). The exposure and field sizes for both projections and both collimation protocols are presented in tabs. 1 and 2.

This research was approved by the Hospital's Medical Ethics Committee. All the participants were informed about the purpose of the study and have given their written consents.

Equipment

The measurements were performed at the Radiology Department of one of the Croatian hospitals that use the CR Fujifilm imaging system (FCR ClearView CS; software version V3.6) on a Siemens Multix/Vertix de-

Figure 1. Example of optimal collimated imaging field for AP and LAT projection of thoracic spine

Table 1. Exposure and collimation protocols for AP projection

AP projection	Current collimation protocol	Optimal collimation protocol
Tube voltage range [kV]	77-96	75-81
Time current product range [mAs]	4.88-62.70 (avg. 25.34)	10.30-63.80 (avg. 30.08)
Source-to-image receptor distance (SID) [cm]	115	115
Image width [cm]	17.9-35.0 (avg. 24.78)	10.7-187.3 (avg. 13.71)
Image height [cm]	34.4-43.0 (avg. 42.22)	35.0-43 (avg. 41.5)

Table 2. The exposure and collimation protocols for the LAT projection

LAT projection	Current collimation protocol	Optimal collimation protocol
Tube voltage range [kV]	81-90	81-87.5
Time current product range [mAs]	5.26-77.10 (avg. 71.39)	7.56-58.80 (avg. 21.36)
Source-to-image receptor distance (SID) [cm]	115	115
Image width [cm]	20.6-35.0 (avg. 29.29)	13.3-21.9 (avg. 17.43)
Image height [cm]	43	37.9-43.0 (avg. 42.88)

vice (tube type: OPTI 150/30/50HC) (fig. 1). Prior to and during the study Quality Control (QC) testing was performed. The conducted tests were the following: tube voltage accuracy and reproducibility, half value layer, tube output (Gy/mAs), linearity (tube current) and variation with tube voltage, automatic exposure control (AEC) testing, dose area product (DAP) meter testing and image receptor testing (spatial resolution, contrast resolution and dynamic range). The measured results were acceptable regarding the standards [11]. The size of the image receiver was 35 cm × 43 cm. The grid ratio was 12:1, with 40 lines per cm, focus-detector distance was 115 cm and the total beam filtration was 2.5 mm Al.

Image quality

The images were assessed by two radiologists and one radiographer with more than 4 years of experience in a blind randomized study. The assessments were made on the same diagnostic monitor (EIZO RadiForce GX340 21.3") by applying ViewDEX [12-14] image software. Two folders were created, one contained 84 radiographs in AP projection and the other 84 radiographs in LAT projection.

All radiographs were assessed on a 3-point scale according to the criteria listed in European guidelines. The ratings on the scale were: score 1 – diagnostically insufficient radiograph, score 2 – diagnostically good radiograph, and score 3 – diagnostically perfect radiograph.

According to the recommendations based on the guidelines in the document IQ and Dose Management For Digital Radiography [15], the criteria for an optimal image that apply for thoracic spine imaging are as follows.

The criteria for AP projection:

– Complete imaging of thoracic spine, including Th1.
– Visually sharp imaging in a single line of the upper and lower-plate surface in the centred beam area.
– Visually sharp imaging of the pedicle, spinous processes and costovertebral joints.

The criteria for LAT projection:

– Complete imaging of the thoracic spine from Th2 down to the thoracolumbar junction.
– Visually sharp imaging in a single line of the upper and lower-plate surfaces in the centred beam area.
– Visualisation of the intervertebral spaces and intervertebral joints in the centred beam area.
– Visually sharp imaging of the cortical and trabecular structures.

The scores for each criterion were then determined by a voting system where the most common grade (mode) for the image was set as the grade for that specific criterion. If evaluators gave different scores (1, 2, and 3) for a specific criterion, then the score was set as diagnostically good (score 2). After that, the sum was calculated for each image and presented as the total score for the image.

Organ absorbed dose calculations

Doses absorbed by selected radiosensitive organs that lie close to or within the primary beam (the organs are listed at the end of this chapter) were calculated by using the Monte Carlo simulation program PCXMC 2.0 (STUK, Radiation and Nuclear Safety Authority in Finland) [16].

Patient height and weight, image field size, exposure parameters and DAP values were used for calculations. DAP was measured by using a built-in DAP meter (VacuDAP compact; VacuTec, Germany), calibrated prior to the study.

Calculations were based on the mathematical probability of interactions between photons and patient's body, such as photoelectric effect, coherent scatter and incoherent scatter. During the simulation, the maximum energy of photons was set (100 keV), and the number of tracked photon particles was 1000000 [16]. The data on image field size, exposure conditions, weight and height were used for each radiograph/patient individually. For each patient first the weight and height were inputted in the PCXMC 2.0 program so that the phantom used was the same size as the patient. After the program had changed the size of the patient the imaging field size that was collated for each patient was set in the program and then the positioning of the imaging field was done based on the patient's radiographic images. The organ absorbed dose calculations were performed for each patient according to Monte Carlo simulation. The anode angle of 12°, exact tube voltage used (kV), filtration and measured DAP value were set in the program for each patient separately.

The positioning of the imaging field was done so that the first and the last ribs were shown in the image as in the example shown in fig. 2.

The average organ absorbed dose was calculated for the following radiosensitive organs lying in the vicinity or within the primary beam: active bone marrow, adrenals, gall bladder, heart, liver, lymph nodes, lungs, oesophagus, pancreas, stomach, thyroid gland and thymus. In the female population, the breast dose was also observed. The average organ dose is the average calculated from all the average dose calculated for each individual organ.

Statistical analysis

The measurements were analysed with the IBM SPSS STATISTICS version 25 (IBM corporation, USA). Shapiro – Wilk test was used to check the normal distribution of the sample. In the case of normally distributed data, *T*-test for independent samples was used for comparing the differences between data. Otherwise, when the data were non-normally distributed, a non-parametric version of *T*-test: Mann Whitney *U*-test was used. The results were presented in the form of tables and in graphic form with a boxplot chart. The significance of $p < 0.05$ was used for all the tests.

RESULTS

For each projection, AP and LAT, a total of 84 BMI, image field sizes, DAP, average organ doses and 252 IQ assessments were collected. The results of all the listed values for AP projection are summarized in tab. 3 and for the LAT projection in tab. 4.

Absorbed doses by selected organs are presented in tab. 5 for the AP projection and tab. 6 for LAT projection.

Organs that received the highest dose during the AP projection of thoracic spine radiography were the following: thymus, heart, stomach, lungs and liver; while during the LAT projection, lungs and liver received the highest dose.

The results regarding the IQ are presented as average for each criterion, figs. 3 and 4.

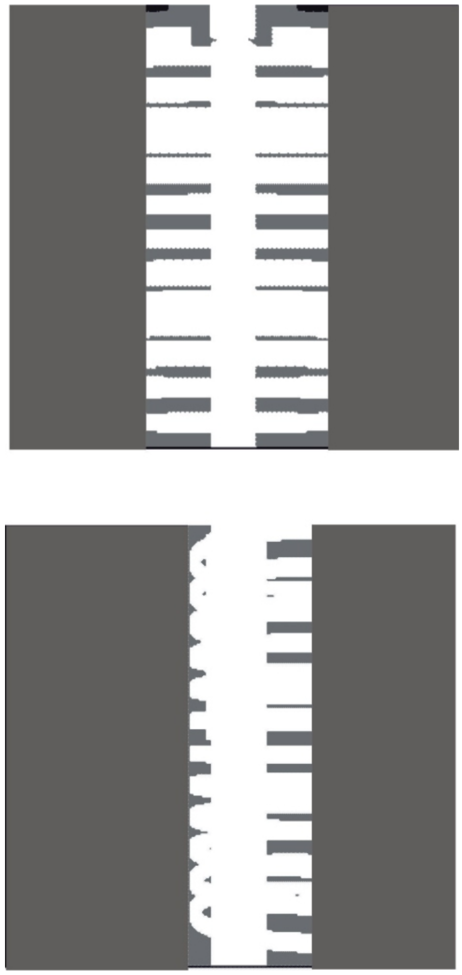

Figure 2. Example of image field positioning in PCXMC 2.0 program for AP and LAT projection of thoracic spine

DISCUSSION

The aim of the study was to optimize the collimation protocol for thoracic spine radiography in AP and LAT projection in one of Croatian hospitals and to evaluate its impact on patient dose (including DAP, absorbed dose to selected radiosensitive organs) and IQ.

According to the BMI results obtained in the beginning there were no statistically significant differences between current and optimal collimation, therefore, all the other values could be compared since patient size would not affect the results.

The results of optimal image field collimation compared to the collimation in line with the standard protocol used in the hospital showed reduction of primary beam size in AP projection by 474.7 cm² (45 %) and in LAT projection by 512.1 cm² (41 %). Primary beam size reduction caused DAP reduction, more specifically in AP projection by 34 % and in LAT projection by 23 %. This data is of great importance as insufficient collimation has been identified as the largest and most common cause of unnecessary patient dose

Table 3. Results of the research for AP projection

Variable	Collimation	Mean	Standard deviation	Median	Minimum	Maximum	Difference	*p*-value
BMI*	Standard	26.9	6.0	25.0	18.8	46.9	0.1	0.549
	Optimal	26.8	4.3	25.9	18.6	35.6		
Image field size [cm^2]	Standard	1046.2	168.2	1029.9	729.3	1505.0	474,6 (45 %)	<0.001
	Optimal	571.5	93.4	579.0	374.5	743.9		
DAP [μGym²]*	Standard	92.0	53.4	81.6	13.1	234.0	30.9 (34 %)	0.007
	Optimal	61.2	31.5	54.0	15.0	135.1		
Avg. organ absorbed dose [μGy]	Standard	334.4	182.6	304.0	59.4	840.4	26 %	/
	Optimal	265.1	132.8	236.3	68.9	631.3		
Total IQ evaluation*	Standard	6.8	1.7	6.5	3.0	9.0	13 %	0.003
	Optimal	7.8	1.4	9.0	5.0	9.0		

*non-parametric test was used to calculate the *p* value

Table 4. Results of the research for LAT projection

Variable	Collimation	Mean	Standard deviation	Median	Minimum	Maximum	Difference	*p*-value
BMI*	Standard	26.9	6.0	25.0	18.8	46.9	0.1	0.549
	Optimal	26.8	4.3	25.9	18.6	35.6		
Image field size [cm^2]	Standard	1259.5	210.7	1243.1	885.8	1505.0	512.1 (41 %)	<0.001
	Optimal	747.4	59.4	765.4	571.9	941.7		
DAP [μGym²]*	Standard	80.2	54.6	59.8	23.7	243.2	18.7 (23 %)	0.040
	Optimal	61.5	43.3	48.8	19.7	184.8		
Avg. organ absorbed dose [μGy]	Standard	96.3	57.8	77.2	31.5	281.3	28 %	/
	Optimal	70.9	46.3	57.1	25.1	210.1		
Total IQ evaluation*	Standard	7.8	1.2	8.0	4.0	12.0	15 %	0.079
	Optimal	8.6	1.8	8.0	5.0	12.0		

*non-parametric test was used to calculate the *p* value

load. In comparison with DRL given in European Commission report [2] we found lower DAP values in our study. Before field size collimation optimization, the DAP value was by 29 % and 53 % lower in AP and LAT projection of the thoracic spine than the DRL given in the report, respectively, while after optimization, the DAP value was by 53 % and 64 % lower in the AP and LAT projection, respectively.

We did not find any similarly performed research in the reviewed literature regarding the organ absorbed doses to selected radiosensitive organs during the radiography of thoracic spine. In our study, the organs that received the highest dose in AP projection were: the thymus, heart, stomach, lungs and liver and in LAT projection, the lungs and the liver. With the optimal collimation, noticeable reductions in absorbed doses were achieved during AP projection for: lungs (64 %), stomach (61 %), liver (37 %), active bone marrow (29 %) and lymph nodes (23 %); and in LAT projection for: thyroid (46 %), heart (40 %), gall bladder (38 %), stomach (37 %), liver (23 %), lymph nodes (22 %), lungs (21 %), thymus (20 %), and pancreas (12 %).

We would like to emphasize the importance of collimation in the imaging of the thoracic spine (both AP and LAT projections) relating to the doses received by the breast. Namely, in the research we found that with optimal collimation in each projection, both AP and LAT, of thoracic spine, we would provide 89 % lower absorbed dose to the breast. This result is of great value as it is a highly sensitive organ to ionizing radiation (weighting factor – 0.12; ICRP 103) [5] and during this examination it is not possible to protect this area with lead protection. From this we can conclude that optimal use of collimation is a powerful tool that can be easily used to prevent unjustified patient exposure.

As an additional benefit of proper collimation and consequently the remarkable dose reduction, Robinson *et al*. [16] stated that it significantly reduces the risk of cancer incidence.

As the final part of the research, we investigated the influence of collimation on IQ, as it is crucial for imaging diagnostics. In AP projection of thoracic spine the improvement of IQ by 13 % ($p = 0.001$) was found when the optimal collimation protocol was used in comparison with the standard one used in the hospital, while in the LAT projection no statistically significant difference ($p = 0.079$) in IQ was found when collimation protocol mentioned in professional literature was used. That means that better IQ was achieved in the AP projection by implementing the optimal collimation protocol and appropriate positioning. Our conclusions are in accordance with results of Karami and Zabihzadeh [10] and Miletić [17], stating that optimal collimation also contributes to IQ improvement since greater collimation reduces the effect of scattered radiation.

Table 5. Specific absorbed organ dose in AP projection of the thoracic spine

Organ	Optimal collimation	Mean stdev. [μGy]	Mean error [%]	Median [μGy]	Minimum [μGy]	Maximum [μGy]	*p*-value
Active bone marrow	No	91.7 45.2	0.3	86.3	17.6	214.6	0.004
	Yes	64.9 27.6	0.3	60.4	18.1	142.4	
Adrenals	No	91.0 39.7	1.8	83.2	23.1	194.2	0.188
	Yes	79.5 29.3	1.8	71.5	21.4	176.0	
Gall bladder	No	210.7 138.5	2.2	171.2	50.6	698.6	0.083
	Yes	151.3 82.1	2.2	147.2	6.6	325.5	
Heart	No	650.9 342.2	0.6	619.7	119.5	1759.0	0.816
	Yes	657.8 292.1	0.5	588.0	212.5	1429.3	
Liver	No	284.1 137.3	0.5	258.7	55.0	564.9	<0.001
	Yes	178.8 76.2	0.5	161.8	33.2	378.7	
Lymph nodes	No	147.6 70.8	0.5	136.8	43.7	309.3	0.028
	Yes	113.1 48.2	0.5	100.0	25.5	243.0	
Lungs	No	307.0 149.9	0.5	256.1	58.6	593.1	<0.001
	Yes	110.0 41.9	0.6	105.8	30.2	234.9	
Oesophagus	No	177.4 81.4	2.3	169.8	40.7	425.2	0.865
	Yes	173.8 66.9	1.9	158.5	57.2	382.4	
Pancreas	No	223.7 111.3	1.7	204.4	0.1	509.9	0.133
	Yes	191.6 79.8	1.6	165.2	27.3	400.0	
Stomach	No	365.7 196.8	1.1	287.8	75.2	824.3	<0.001
	Yes	143.2 72.34	1.3	132.5	13.1	296.7	
Thyroid	No	197.7 162.7	4.0	171.7	17.5	713.7	0.844
	Yes	214.6 230.2	3.5	136.5	13.9	1235.7	
Thymus	No	1131.4 629.4	1.7	1096.4	195.3	3164.3	0.201
	Yes	1313.7 658.0	1.3	1192.9	422.9	2861.6	
Breasts*	No	468.2 268.6	0.7	411.3	75.2	954.9	<0.001
	Yes	53.6 21.6	1.4	51.2	14.1	101.2	

* The organ dose was calculated only for female patients (n = 70)

It should also be noted that IQ was evaluated by 2 radiologists and 1 radiologic technologist, and the ratings of the assessors differed. However, mean IQ scores were higher for each criterion in the group with optimal collimation, as well as in AP and LAT projection. In order to avoid the subjective evaluation of individual evaluators and to achieve greater accuracy and objectivity of this part of the research, a comparison could be made of objective quality assessment criteria, such as signal-to-noise ratio and contrast-to-noise ratio.

CONCLUSIONS

By optimal collimation in thoracic spine radiography, the image field size, DAP, and the mean absorbed dose to the selected organs was on the average reduced by 43 %, 29 %, and 27 %, respectively, for both AP and LAT projection. In addition, the optimal collimation protocol improved image quality by 13 % in AP projection. No differences in image quality were found in LAT projection.

The results of the research prove that there is plenty of room for improvement in clinical practice regarding dose reduction and image quality by taking simple steps like proper use of collimation guidelines which can easily improve the outcomes of radiography procedures that are among those with the highest patient radiation dose.

AUTHORS' CONTRIBUTIONS

Preparations of the research plan, ViewDEX for image evaluation were made by N. Mekiš and D. Škrk. Data collection and preparation for data analysis were contributed by A. Pažanin. Data analysis was made by A. Pažanin, and N. Zalokar. All the authors have contributed to article preparation.

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Table 6. Specific absorbed organ dose in LAT projection of the thoracic spine

Organ	Optimal collimation	Mean stdev. [μGy]	Mean error [%]	Median [μGy]	Minimum [μGy]	Maximum [μGy]	*p*-value
Active bone marrow	No	82.5 47.6	0.3	69.2	29.3	211.1	0.458
	Yes	77.4 48.1	0.3	62.6	28.2	210.0	
Adrenals	No	80.5 38.7	1.6	67.6	34.4	193.2	0.145
	Yes	97.8 56.2	1.6	81.9	35.1	246.4	
Gall bladder	No	42.0 20.2	3.8	35.4	12.8	94.7	<0.001
	Yes	25.9 16.9	4.3	20.6	7.7	84.1	
Heart	No	99.0 49.1	1.2	80.7	31.8	234.7	<0.001
	Yes	59.6 41.1	1.4	48.3	20.4	176.8	
Liver	No	278.3 148.2	0.4	220.0	106.9	757.7	0.006
	Yes	214.1 150.2	0.5	172.1	75.7	715.7	
Lymph nodes	No	44.9 23.1	0.8	37.0	15.6	106.6	0.004
	Yes	35.0 22.4	0.8	28.4	12.7	98.0	
Lungs	No	278.3 163.6	0.5	233.4	96.4	735.3	0.018
	Yes	221.0 152.1	0.5	172.9	75.4	654.5	
Oesophagus	No	98.9 49.2	2.8	89.3	36.9	249.6	0.900
	Yes	102.2 60.1	2.6	83.0	39.0	282.6	
Pancreas	No	35.7 ± 15.0	3.5	30.6	13.8	73.2	0.037
	Yes	31.4 18.2	3.5	26.0	12.1	85.5	
Stomach	No	10.9 ± 4.3	4.2	9.5	3.7	19.9	<0.001
	Yes	6.9 3.9	4.8	5.3	2.5	17.7	
Thyroid	No	22.5 28.5	9.5	15.1	3.9	188.0	<0.001
	Yes	12.2 8.6	10.9	10.0	4.7	40.9	
Thymus	No	66.2 36.5	5.2	59.6	14.4	192.6	<0.001
	Yes	26.3 17.3	6.9	21.3	8.3	80.7	
Breasts*	No	112.1 127.6	1.7	56.2	9.7	600.5	<0.001
	Yes	12.3 8.4	2.8	10.1	4.6	39.0	

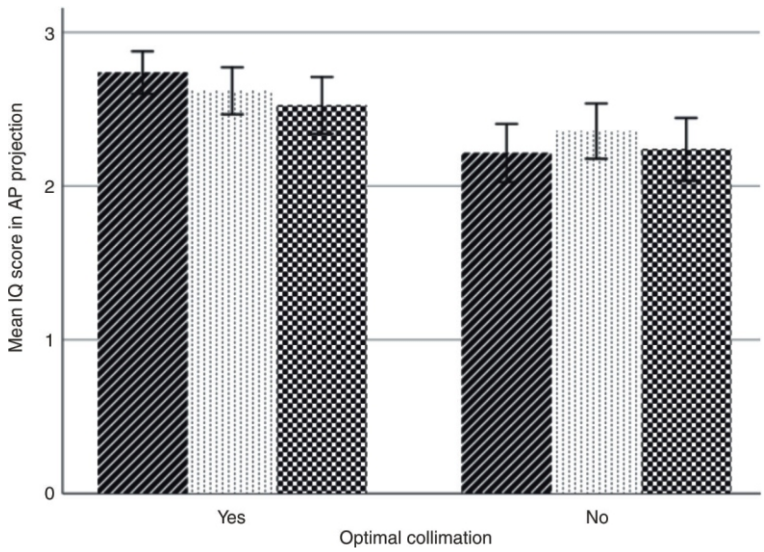

Figure 3. Bar chart for each IQ criterion comparison between optimal and non-optimal collimation in AP projection

Complete imaging of the thoracic spine, including Th1

Visually sharp imaging, as a single line, of the upper and lower-plate surface in the centred beam area

Visually sharp imaging of the pedicle, spinous processes and costovertebral joints

Error bars: 95 % CI

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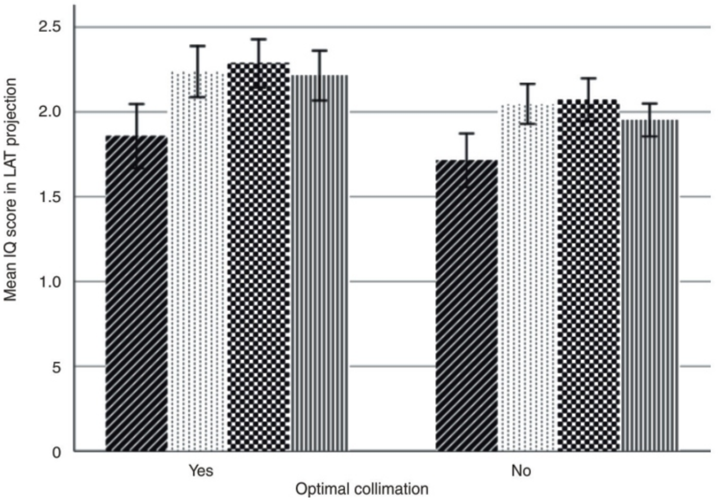

Figure 4. Bar chart for each IQ criterion comparison between optimal and non-optimal collimation in LAT projection

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УТИЦАЈ ПРАВИЛНЕ КОЛИМАЦИЈЕ НА ДОЗУ ЗРАЧЕЊА И КВАЛИТЕТ СЛИКЕ ПРИ РАДИОГРАФИЈИ ТОРАКАЛНЕ КИЧМЕ

Циљ овог истраживања је утврђивање утицаја колимације снопа на пацијентну дозу и квалитет слике при радиографији торакалне кичме. Студијом су обухваћена 84 пацијента који су били упућени на снимање торакалне кичме. Пацијенти су насумично били подељени у две групе од по 42. Прва група снимана је према стандардном протоколу за колимацију који се примењује у једној од болница у Хрватској док је друга група снимана применом “оптималне” колимације. Величина поља колимисана је засебно за сваког пацијента или према колимацији за највеће поље на основу података доступних у професионалној литератури. За сваког пацијента забележени су индекс телесне масе, величина поља, параметри експозиције и производ дозе и површине, израчуната је апсорбована доза у органима и оцењен квалитет слике. Није било статистички значајне разлике у индексу телесне масе за обе групе пацијената. Са оптималном колимацијом, величина поља при антеропостериорној пројекцији смањена је за 45 % ($p < 0.001$), а при латералној пројекцији смањена је за 41 % ($p = 0.007$) при антеропостериорној пројекцији и 23 % ($p = 0.040$) при латералној пројекцији. Средња апсорбована доза у одабраним органима умељена је за 26 % при антеропостериорној пројекцији, а за 28 % при латералној пројекцији. Додатно, протокол са оптималном колимацијом побољшао је квалитет слике за 13 % при антеропостериорној пројекцији. При снимању у латералној пројекцији нису уочене разлике у квалитету слике. Овим истраживањем показали смо да оптимална колимација при радиографији торакалне кичме има значајан утицај на излагање пацијента зрачењу и има позитивни утицај на квалитет слике.

Кључне речи: радиографија торакалне кичме, колимација, смањење дозе, квалитет слике