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CONSTRUCTION DESIGN OF AN ASSISTING TOOL FOR IMMOBILIZATION IN THORAX AND ABDOMEN EXAMINATION ON PEDIATRIC PATIENTS

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ABSTRACT

Background: *The main idea of designing an assisting tool for immobilization in pediatric thorax and abdomen examinations is that there are radiographer's difficulties while performing radiographs, especially pediatric thorax and abdomen.*
Aims: *This study aims to design of appliance assist for immobilization thorax and abdomen examination on pediatric patients.*
Methods: *This study was an exploratory experiment by designing, applying and testing the construction of an assisting tool for immobilization in thorax and abdomen examination on pediatric patients. The methods used in data collection were interview and observation. Function test results were analyzed based on the check list of the respondents regarding the feasibility of the tool.*
Results: *an assisting tool for immobilization in thorax and abdomen examination on pediatric patients was designed in examination table-shaped made of basic materials such as acrylic, hollow steel and Eser steel plate. Function test on the work of the assisting tool was performed by 6 respondents who applied it to the patient. Based on the function test results, there was of 89,5% respondents who stated that the tool for immobilization in thorax and abdomen examination on pediatric patients could help the performance of the radiographer in positioning and reducing the patient's movement and there was no artifact in the radiographs.*
Conclusion: *Function test results showed that the tool design could reduce the movement of patients and may replace the function of others to resist the movement of the patient. An assisting tool for immobilization in thorax and abdomen examination on pediatric patients should be improved further especially in choosing the material used, so that the toll will be lighter and can better reduce the patient's mobility and the size should consider the average height of the pediatric patients.*

Keywords: *Construction Design, Thorax and Abdomen Immobilization, Pediatrics.*

INTRODUCTION

In radiographic examination, the presence of assisting tools is indispensable. The tools aim to help the performance of the radiologist in positioning the patient and the cassette as well as possible so that it will produce maximum radiographs of a radiographic examination. There are various assisting tools, such as sand bag, weighted angel block, head clamp, press chollers,

octagonal immobilization, tam-em board, Pigg-o-stat, tape, sheets or towels, covered radiolucence sponge blocks, compression bands, stockinette and face bandages [1].

Some examination assisting tools have specific characteristic that is can only be used in a specific examination and each has disadvantages, for example tam-em-board is an assisting tool for the examination on pediatric patients in supine position but there can still be a movement in the shoulder, then pig-o-stat is an examination assisting tool for the abdomen and thorax erect projection in pediatric patients which can only be used in pediatric patients who have been able to stand, and its use is less comfortable and causes pain. There is no literature that describes the development of assisting tools for pediatric examination in Indonesia.

The most widely performed radiography examination in hospitals and clinics is thorax examination. The radiologists agree that in most of the thorax examinations in pediatric patients, erect position is better than the supine position for more information. However, knowing how to get good radiographs quality in both positions is very important. Beside the position of the body, an accurate diagnosis is also dependent on the quality of images produced by short exposition time to cope with the movement. Taking image at the time of expiration may lead to an incorrect interpretation of the radiologist. Therefore taking image at the time of maximal inspiration is important to get the right diagnosis. Radiographs obtained from a good position and without rotation is also important for the correct diagnosis because a little rotation can cause significant deformation of the normal anatomy [2].

The reason for abdominal examination in pediatric patients different from adult patients in terms of the exposition and position factors of the patient. So, the examination technique or inspection procedures are very different. In addition to supine and erect position, assessment of acute abdominal condition or serial abdomen in adult patients usually also required additional left lateral decubitus position. In general, serial abdominal examination is incomplete without examination of the thorax with PA projection. To minimize radiation, serial abdominal examination in pediatric is performed 2 times: abdominal supine and an image showing air-fluid level. Erect position is preferred rather that the lateral decubitus position for patients under the age of 2 to 3 years, because in terms of immobilization and patient comfort, it is an easier position. Erect position can be obtained by a slight modification of Pigg-O-Stat, while lateral decubitus position requires significant modification of Pigg-O-Stat [2].

Based on the observations while conducting field work in some Radiology Installations, it was found that radiographers had difficulty to perform radiographic examination, especially pediatric thorax and abdomen. Radiographers need parents' help in doing immobilization to perform an examination. When the patient was crying and refused to do the examination, the parents should held directly to resist the movement of the patient, so as to reduce errors in thorax and abdomen radiographs. If there is movement during exposition progress it will affect the quality of the radiograph resulted. For that we need the tools to solve these problems by designing a the assisting tool for immobilization in thorax and abdomen examination on pediatric patients to help immobilize patient in thorax and abdomen radiographic examination, especially in pediatric patients.

METHODS

This study was an exploratory experiment by designing, applying and testing the construction of an assisting tool for immobilization in thorax and abdomen examination on pediatric patients. Data collection method was conducted by the researchers were interviews and observation.Interviews were conducted to obtain data from the function test of the tool by

fulfilling the questionnaire in the form of a check list by the respondents. Researchers observed the use of the assisting tool for immobilization in thorax and abdomen examination on pediatric patients under the age of 3 years and see how the use of these tools.

RESULTS

After the assisting tool for immobilization in thorax and abdomen examination on pediatric patients was made by using the materials ofhollow steel and Eser steel plate, dense foam, waterproof fabric, velcro strip and acrylic, next step was performing function test on the work of the assisting tool by 6 respondents and the results can be seen in the table below:

Table 1. Table of recapitulation of the check list

No	Respondent	Number of Question	Supported	Did not support
1	Respondent 1	8	8	0
2	Respondent 2	8	8	0
3	Respondent 3	8	6	2
4	Respondent 4	8	7	1
5	Respondent 5	8	7	1
6	Respondent 6	8	7	1
	TOTAL	48	43	5

Referred to support is that these tools can assist respondents in to immobilize the patient, put the cassette in proper position, the examination time becomes shorter and not causing artifacts.

To determine whether the assisting tool for immobilization in thorax and abdomen examination on pediatric patients cause artifacts on the radiographs or not, the researchers used two image receptors in the form of imaging plate and radiographic film.

Figure 1. Results of radiographs of the patients with the tool in abdominal examination by using an image receptor in the form imaging of plate

Figure 2. Results of radiographs of the patients with the tool in thorax examination by using an image receptor in the form of radiographic film.

Of the two radiographs produced by the assisting tool for immobilization in thorax and abdomen examination on pediatric patients by using image receptors in the form of imaging plate and radiographic film, it can be seen that the tool did not cause artifacts which can interfere with important anatomical part in the radiograph.

DISCUSSION

There are a wide variety of assisting tools, especially for pediatric patients. However, based on observations while conducting field work practice, some Radiology Installations, did not have assisting tools for pediatric patients so that the radiologist experienced difficulties in pediatric radiography examination. Thus, the researchers designed the assisting tool for immobilization in thorax and abdomen examination on pediatric patients [1].

The assisting tool for immobilization in thorax and abdomen examination on pediatric patients is a tool designed to help immobilize patient in thorax and abdomen radiographic examination, especially in pediatric patients. The materials used to make this tool is hollow steel, Eser steel plate, dense foam, waterproof fabric, velcro strips and acrylic. Acrylic material was chosen because of the radiolucency characteristic, so it does not interfere with radiographs [3]. In the making process of this tool, electric welding was more used of to unify each part, but there were some sections were joined together by bolts that were acrylic part and headrests with the tool framework.

In this tool, patients could lie down comfortably, because the tool was quite wide. Acrylic was placed between the patient and the cassette which served as a barrier and the base of the patient. The movement of the cassette could be adapted to the Central Point in patients so that it could be arranged as a cassette on the examination table of general X-ray machine. Headrest was made of dense foam that can provide comfort for the patient. This headrest was coated with water resistant fabric and easy to clean. In this tool there were velcro strips that serve as the immobilization of the patient's movements. The velcro strips made of fabric that can be penetrated by X-rays. In addition, the location of the velcro strips could be adjusted to the patient's body.

Based on the recapitulation of the check list results on the assisting tool for immobilization in thorax and abdomen examination on pediatric patients that have been calculated by using a predetermined formula, then it was obtained a percentage of 89.5%. Based on the percentage value it can be concluded that the assisting tool for immobilization in thorax and abdomen examination on pediatric patients could help the radiographer performance in positioning the patient, cassette and reduced the patient's movements and did not require assistance from the patient's parents to hold the patient during the examination.

When respondent used the assisting tool for immobilization in thorax and abdomen examination on pediatric patients, there were obstacles associated with the mobilization of the tool, it was because the materials used ere too heavy. Nonetheless, the cassette placement when the tool was used was more easily and did not need the help of parents to hold the patient. By using normal exposition factor for pediatric patients, radiograph results from the use of this tool did not cause artifacts.

From the test results, the assisting tool for immobilization in thorax and abdomen examination on pediatric patients had some advantages and disadvantages. The advantages of the assisting tool can reduce the patient’s movements so as to produce the optimal radiographs, can help to postion the patient and the cassette so that they are perpendicular to the direction of the X-rays. And do not cause artifacts which can interfere with important anatomical part in the radiograph. And the disadvantages is the weight of the tool is heavy enough so for female radiographer require more energy to move the tool.

CONCLUSION

Based on the function test results, the assisting tool for immobilization in thorax and abdomen examination on pediatric patients could help the radiologist performance. From the results of recapitulation it can be concluded that the tool could assist the radiologist in positioning the patient and reducing the patient's movements, as well as there was no artifact in the radiographs.

Based on the conclusion, the recommendations are:Should be improved further especially in choosing the material used, so that the toll will be lighter and can better reduce the patient's mobility. To better reduce the patient's mobility, the tool should use stronger strap material to assist patient immobilization optimally. The size of the assisting tool for immobilization in thorax and abdomen examination on pediatric patients should consider the average height of the pediatric patients.

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