WELCOME (WEALTH COMMUNITY EMPOWERMENT) JOURNAL

APPLICATION OF THE DESIGN AND CONSTRUCTION RESULTS OF AN OBLIQUE LUMBAR RADIOGRAPHY EXAMINATION AID

https://ejournal.poltekkes-smg.ac.id/ojs/index.php/welcomejournal

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ABSTRACT

Oblique lumbar radiographic examinations require assistive devices to facilitate patient positioning and produce accurate radiographs showing the Scottie dog sign. Oblique lumbar patient positioning requires the patient to be tilted 45 degrees to the right or Right Posterior Oblique (RPO) and 45 degrees to the left or Left Posterior Oblique (LPO). The results of the design and construction of the oblique lumbar radiography examination aid need to be implemented in real-world healthcare services within the hospital's radiology unit. The purpose of this community service is to introduce, educate, and implement the results of the design and construction of an oblique lumbar radiography examination aid. The community service methods are thru lectures, discussions, and hands-on practice. The community service element involves Radiographers in hospitals where there is a demand for oblique lumbar radiographic examinations, as well as student interns. The direct application of the oblique lumbar radiographic examination aid by Radiographers on patients has successfully produced oblique lumbar radiographs that clearly show the Scottie dog sign, thereby improving healthcare services, particularly in the field of radiology.

Keywords: radiography lumbar oblique; examination aid, scottie dog

Introduction

Oblique lumbar radiographic examination plays a very important role in establishing a clinical diagnosis in the lumbar area. Conventional radiographic examination of the lumbar vertebrae is very important. One of the reasons is to check for compression on the lumbar pars interarticularis, which can lead to spondylolysis (1) (2). Therefore, obliques need to be projected in pairs, right and left. There are other sources that find that an estimated 20% of stress fractures in the pars interarticularis can only be identified with conventional lumbar oblique radiographic examinations (3). The contour of the prominence on the pars interarticularis with reactive sclerosis on the contralateral pedicle can be well visualized using conventional radiography (4).

A lumbar examination with oblique projections is performed with the patient in the right posterior oblique (RPO) and left posterior oblique (LPO) semi-supine positions, or in the right anterior oblique (RAO) and left anterior oblique (LAO) semi-prone positions. Positioning the object by rotating the body 45° and aligning the spinal column parallel to the midline of the examination table and/or the IR. Wedges are highly recommended to prevent the patient from having to grip the edge of the table, which could pinch the patient's fingers. The oblique projection lumbar visualization is characterized by the distinctive "Scottie Dog" appearance. The parts that form the Scottie Dog image, primarily the

dog's head and neck, are the most easily recognizable features. The neck is one of the pars interarticularis (a part of the lamina that primarily forms the shoulder region of the dog). The dog's ear is one part of the superior articular process, while the eye is formed by one part of the pedicle. One of the transverse processes forms the nose. The front legs are formed by one of the inferior articular processes (5). Accurate 45° oblique positioning is indicated by an open zygapophyseal joint and the pedicle (the eye of the "Scottie dog") being centered and located on the anterior midline of the vertebral body. A pedicle visible on the posterior side of the vertebral body indicates overrotation, while a pedicle visible on the anterior side of the vertebral body indicates underrotation (6).

Oblique lumbar examinations in the hospital's radiology department have historically been performed by estimation only, in terms of adjusting the rotation of the object or angling the object by 45° relative to the image receptor. Consequently, the positioning of the oblique lumbar object becomes less than optimal and is done haphazardly. This resulted in the scottie dog sign not being well visualized, even tho it is important for showing part of the lumbar pars interarticularis. Consequently, the diagnosis was not optimally established. Difficulty in positioning the object for oblique lumbar examinations presents a unique challenge for a Radiographer when positioning the lumbar object obliquely. Consequently, oblique projections of the lumbar spine are often omitted simply because of the difficulty in positioning the object. Therefore, an examination aid is needed to facilitate obtaining the oblique lumbar object position.

The lumbar examination aid has been successfully designed with specifications using 5mm thick acrylic as the base material. The dimensions of the aid have been adjusted to the examination table and the human body, particularly the abdomen and back. The lumbar oblique radiographic examination aid has also been tested on subjects for positioning simulation and on a phantom for taking radiographs. The results of taking radiographs on the phantom successfully showed a good image of the lumbar spine with the "Scottie dog" appearance (7).

Methods

This community service activity will be carried out at Poltekkes Kemenkes Semarang and also Primaya Hospital from July to August 2025. The target audience for this community service activity is hospital radiographers who require oblique lumbar radiographic examinations, as well as student interns. The connection is that they are at the forefront of reaping the benefits from the application of oblique lumbar radiographic examination aids. The service methods used include 3 (three) stages: (1) The preparation stage, which includes identifying problems and potential solutions, preparing a community service activity proposal, and preparing banners for information and promotion. (2) The implementation stage, which consists of delivering material and providing hands-on practice in using assistive devices. (3) The evaluation stage, which involves participants completing a questionnaire with 9 evaluation items.

The evaluation of the performance of the assistive device includes: (1) The device is lightweight and easy to move; (2) The device design meets the needs; (3) The device is easy to store; (4) The device is easy to use; (5) The device facilitates positioning; (6) The device does not cause artifacts; (7) The device can improve the quality of the images produced; (8) The device is used routinely; (9) The device can be replicated for other hospitals. The assessment method uses a Likert scale, with each assessment item having a highest score of 4 and the following criteria: 4 = strongly agree; 3 = agree; 2 = somewhat agree; and 1 = disagree. Then, the results of the assessment were calculated as a percentage (8).

Results and Discussion

The community service activity was carried out well and smoothly. The results of the community service implementation are compiled and adjusted, including the preparation, implementation, and evaluation. During the preparation stage, a coordination briefing was conducted successfully for the community service team's preparations. The banner about the oblique lumbar radiographic examination aids was also successfully

achieved as an information and promotional medium.

The next stage involves implementing community service activities, which will commence in July 2025 at the JTRR Laboratory of the Semarang Ministry of Health Polytechnic and at Primaya Hospital. In the JTRR laboratory, the equipment will be used for students' practical exercises in oblique lumbar radiography examinations. Meanwhile, at Primaya Hospital, assistive devices have been used for approximately 2 months. During the implementation phase, the service team introduced assistive devices, provided education on the importance of accuracy in positioning for oblique lumbar radiographic examinations, and ensured the production of informative radiographs with a clear image of the Scottie dog sign. Simultaneously, the use of the assistive device was simulated with the help of students in preparing the equipment and positioning. The service team also provided a grant of oblique lumbar radiography examination aids to the radiology department of Primaya Hospital, represented by Mr. Kurniawan Saputra, as the head of the radiology department, as shown in Figure 1.

Figure 1. Handing over the grant of oblique lumbar radiography examination aids to the Radiology Department of Primaya Hospital Semarang

The evaluation stage was obtained from the assessment of the assistive device's performance thru questionnaires completed by Radiographers and student interns. The evaluation of the assistive device's performance, which included 9 assessment items, received an average score of 94.94%. The device was light and easy to move, scoring 93.18%. The design of the device met the needs, receiving a score of 95.45%. The device was easy to store, scoring 95.45%. The device was easy to use, scoring 95.45%. The device facilitated positioning, scoring 97.73%. The device did not cause artifacts, scoring 90.91%. The device improved the quality of the images produced, scoring 97.73%. The device was used routinely, scoring 93.18. The device could be replicated for other hospitals, scoring 95.45%. The evaluation results can be seen in graph 1, with a total of 11 evaluators who have actually used the device.

Figure 2. Chart of Performance Assessment for Oblique Lumbar Radiography Examination Aids

The highest score was for the evaluation item "The tool makes positioning easier," with a score of 97.73%. This indicates that the assistive device is very helpful for Radiographers to work professionally and produce high-quality radiographs. The lowest score was for the evaluation item "The tool does not cause artifacts," with a score of 90.91%. This indicates that artifacts are still present in the radiographs, but they do not obscure the lumbar area being evaluated. Therefore, even with artifacts, the radiographs can still be well evaluated by the Radiologist. The solution provided is to increase the length of the device to cover the thoracic area so that artifacts in the form of lines do not appear at the upper border of the lumbar area.

Additionally, for esthetic purposes, the device can be covered so that the acrylic material is not visible, and an anti-slip coating can be applied to prevent the device from easily shifting during use.

Radiographs produced using the oblique lumbar radiographic examination aid have generally been able to provide good information, as evidenced by the visualization of the "scottie dog sign," where the "dog's eye" (which is the pedicle of the lumbar vertebrae) is depicted in the middle of the vertebrae. This indicates that a 45-degree oblique position is sufficient (9). There is neither over-rotation nor under-rotation, as can be seen in Figure 3.

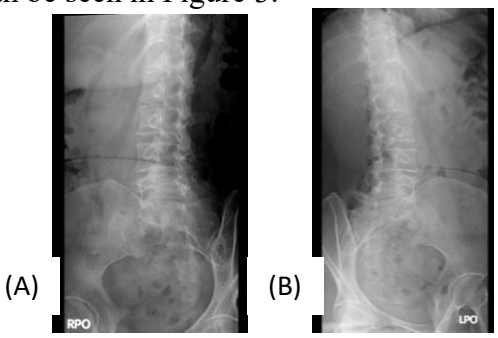

Figure 3. Radiographs of lumbar obliq in RPO (A) and LPO (B) that use Oblique Lumbar Radiography Examination Aid, clearly showing the scottie dog sign

Conclusion

The community service activity involving the application of an oblique lumbar radiography examination aid has been running smoothly. The aid has been used in oblique lumbar examinations by radiographers at Primaya Hospital Semarang and student interns at the hospital. The lumbar oblique radiography examination aid has performed well with an average score of 94.94%. Suggestions for improving the device's design include increasing its length and coating it with a non-slip material to prevent it from shifting easily while being used.

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