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The Effect of Different Monitor Use on Radiography Interpretation in Emergency Medicine

Acil Tıpta Farklı Monitör Kullanımının Radyografi Değerlendirmeye Etkisi

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Abstract

Aim: Although it is recommended to use a medical monitor in radiology guides, it is rare to use a medical monitor in non-radiology departments. In this study, the effect of using LED, tablet and medical monitor in the radiography evaluation of inexperienced physicians in the emergency room was investigated.

Material and Method: Fifty medical intern from the medical school were included in the study. Participants were asked to diagnose pre-prepared radiography sets on LEDs, tablets and medical monitors and to request a radiology consultation for radiographs they could not decide. The diagnoses of medical interns and cases of requesting radiology consultation were recorded.

Results: The median values of the correct diagnosis of the participants according to the monitors; 13.5 on led monitor, 13 on tablet monitor and 16 on medical monitor. The median value of the desired radiology consultation numbers; 6 on led monitor, 7 on tablet monitor and 4 on medical monitor. The medical monitor has statistically significant difference to the other two monitors, in the correct diagnosis and number of consultations desired.

Conclusion: The use of medical monitors by inexperienced physicians in the emergency room where workload is extreme and time is valuable, will increase the diagnosis accuracy and decrease the rate of request for consultation

Keywords: Emergency medicine, radiography, radiologic technology

Öz

Amaç: Radyoloji kılavuzlarında medikal monitör kullanımı önerilmesine rağmen medikal monitörlerin radyoloji dışı bölümlerde kullanımı nadirdir. Bu çalışmada acil serviste tecrübesiz hekimlerin radyografi yorumlanmasına; led, tablet ve medikal monitör kullanımının etkisini araştırdık.

Gereç ve Yöntem: Çalışmaya tıp fakültesinden 50 intörn doktor dahil edildi. Katılımcılardan önceden hazırlanmış radyografi setlerine led, tablet ve medikal monitörlerde tanı koymaları, karar veremedikleri radyografiler için radyoloji konsültasyonu istemeleri istendi. Katılımcıların tanıları ve radyoloji konsültasyonu isteme durumları kaydedildi.

Bulgular: Katılımcıların monitörlere göre doğru tanılarının median değerleri; led monitörde 13.5, tablet monitörde 13 ve medical monitörde 16 olarak bulundu. İstenilen radyoloji konsültasyonu sayılarının medyan değeri; led monitörde 6, tablet monitörde 7 ve medikal monitörde 4 olarak bulundu. Medikal monitör, doğru tanı ve istenilen konsültasyon sayısında diğer iki monitöre göre istatistiksel olarak üstün bulundu.

Sonuç: Tecrübesiz hekimlerin, acil servis gibi iş yükünün fazla ve zamanın değerli olduğu yerlerde medikal monitör kullanmaları tanı doğruluğunu artıracak ve konsültasyon isteme oranını azaltacaktır.

Anahtar Sözcükler: Acil tıp, radyografi, radyolojik teknoloji

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INTRODUCTION

Radiological imaging methods are frequently used examinations in the field of emergency medicine. Conventional radiographs form the basis of radiological imaging and are used in patient management in the emergency service.[1] Rapid and accurate interpretation of radiological images affects patient management positively in emergency departments competing with time.

Led monitors are widely used in non-radiology departments in hospitals. Today, the use of tablets is gradually increasing in medicine as well as in daily life. The use of mobile devices enables the physicians to evaluate the examination at the bedside of the patient and make consultations quickly. In the literature, no significant difference between the led monitor and tablet monitor was found in the studies comparing the two monitors in radiological evaluations.[2,3] Medical monitors become prominent at this point because the brightness level of led screens is not the same in all areas.[4] Although it is recommended to use medical monitors in radiology guidelines, the usage of medical monitors in non-radiology departments is rare.[5-8]

In this study, we investigated the effects of using LEDs, tablets, and medical monitors on radiography interpretation of inexperienced physicians in the emergency service.

MATERIAL AND METHOD

This study was carried out at Balıkesir University between December 2019 and February 2020. 50 medical intern from the medical school who completed their emergency medicine education were included in the study. Participants were asked to diagnose previously prepared radiography sets displayed on different monitors. They were told that they could ask for a radiology consultation for radiographs they could not decide on. Three different sets of radiographs were used in order to prevent the increased experience of medical interns while evaluating the radiographs. Radiography sets were prepared for the study by a radiology team blinded to the study. The sets were created from 20 similar radiographs (10 musculoskeletal, 5 chest, and 5 gastrointestinal) at the same difficulty level, containing the same pathologies. All radiographs were selected from images captured by using the same X-Ray device (XGEO GU60A Samsung, Korea). All participants evaluated the first radiography set on the LED monitor (18.5" VS197D Asus, Taiwan), the second radiography set on the tablet monitor (10.2" iPad 7th generation Apple Inc., Cupertino, CA), and the third radiography set on the medical monitor (21.3" RadiForce GX340 Eizo, Japan); all three sets were displayed over Picture Archival and Communication Systems (PACS). The physical conditions (e.g. light intensity, light angle, etc.) of the place where radiographic images are evaluated are important. Therefore, in our study, physicians utilized the monitors in the same room and under the same physical conditions. The diagnoses of medical interns and the requests of radiology consultation were recorded. The diagnoses given by medical interns to radiographs were evaluated by comparing with the diagnoses specified by the radiology team.

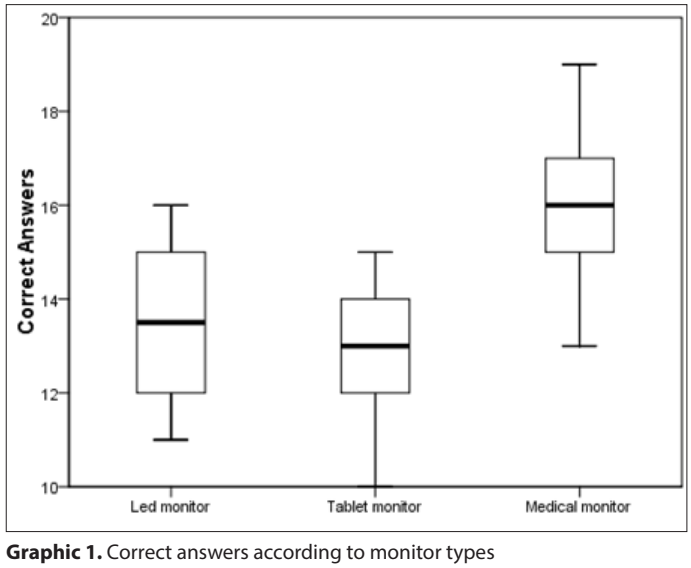
Data analysis

Statistical analyses were done with SPSS 25.0 (IBM Corporation, Armonk, New York, United States) and PAST 3 (Hammer, Ø., Harper, D.A.T., Ryan, P.D. 2001. Paleontological statistics). Mardia's and omnibus tests were performed to check univariate and multivariate normality; whereas, variance homogeneity was tested with the Box-M test. In the comparison of dependent quantitative variables with other measurements, Friedman's two-way test (Monte Carlo) test was utilized. Next, Dunn's test was performed for the post-hoc analysis. Quantitative variables are displayed with minimum and maximum values as well as the median in the tables. Variables were examined at 95% confidence interval and p value was set as less than 0.05 for the significant results.

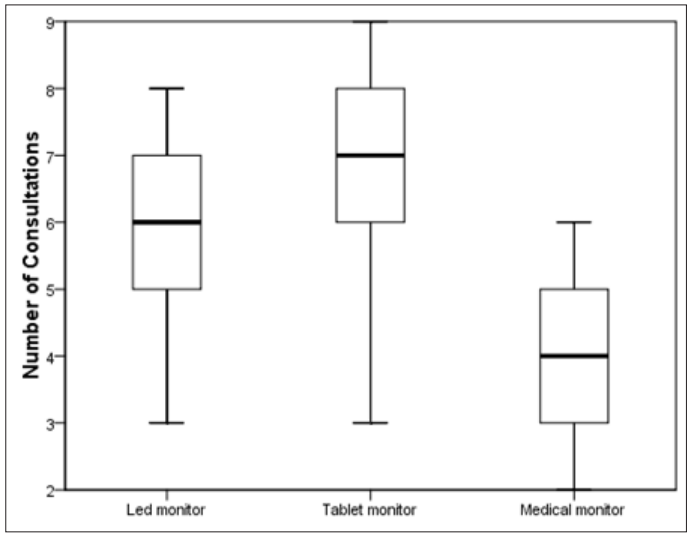
RESULTS

The median values of the correct diagnosis of the participants according to the monitors are as follows: 13.5 on led monitor, 13 on tablet monitor, and 16 on medical monitor. The median value of the number of radiology consultation requests are 6 on led monitor, 7 on tablet monitor, and 4 on medical monitor (**Table 1**).

When the monitors are compared in pairwise; the difference between the led and tablet monitor on the number of correct diagnoses and consultation requests was non-significant. However, the medical monitor was found to be statistically superior to the other two monitors in the correct diagnosis and the number of consultation requests (**Table 1**, **Graphic 1,2**).



Graphic 1. Correct answers according to monitor types



Graphic 2. The number of requested consultations according to monitor types

Table 1: Correct answers and the number of consultation requests on different monitors

		Correct Answers	Number of Consultations
		Median (Min/Max)	Median (Min/Max)
Led Monitor	I	13.5 (11 / 16)	6 (3 / 8)
Tablet Monitor	II	13 (10 / 15)	7 (3 / 9)
Medical Monitor	III	16 (13 / 19)	4 (2 / 6)
P Value		<0,001	<0,001
Pairwise comparison	I→II	0.197	0.531
	I→III	<0,001	<0,001
	II→III	<0,001	<0,001

Friedman Test (Monte Carlo); Post Hoc Test: Dunn's Test

DISCUSSION

In medicine, radiology is prominent among the departments benefiting the most from technological advances. Conventional radiography is one of the most used radiological examinations in the field of emergency medicine where rapid diagnosis and treatment are crucial.[1] Radiographs in emergency departments are generally evaluated on led monitors. With the widespread use of tablet monitors in hospitals in recent years, evaluation of radiological examinations on tablet monitors has increased.[2,9-11] Many studies revealed that tablet monitors can be used to evaluate radiological examinations.[2,12,13] When evaluating radiological examinations, it is extremely important that the screen has resolution, brightness and a wide range of grayscale. Therefore, medical monitors recommended by radiology guidelines are used as the gold standard.[5-8] Studies showed that tablet and led monitor have the same power of performance, and there is not significant difference between LED / LCD monitor and medical monitor.[9-13] There are studies in the literature showing that physician's performance is not affected by monitors.[14,15] However, the level of experience of physicians did not take place in these studies. We think that the physician's experience is important in radiological evaluations. Unlike the literature, in the current study, we compared the effects of three different monitors on conventional radiography evaluation performance of inexperienced physicians who are medical interns. To the authors' knowledge, the effects of these three monitors on radiography evaluation in the emergency service were not investigated yet.

In our study, there was not statistically significant difference between led and tablet monitors. However, the medical monitor provided higher diagnostic accuracy than the other two monitors. In addition, physicians requested fewer consultations while using the medical monitor. According to the results, the medical monitor enabled physicians to make more accurate and precise decisions. In addition to the literature, we think that medical interns benefit more from medical monitor's visual features because they are inexperienced. The effect of the medical monitor on increasing diagnostic accuracy and reducing the number of consultation request was also statistically significant ($p<0.001$).

Although it was recommended in the guidelines that monitor size should be wider than 15" for radiological evaluations, the size of the tablet monitor we used was 10.2".[5,8] However, it can be seen from the results that the tablet monitor has no disadvantages compared to the led monitor. Tablet monitors provide physicians with the advantage of radiographic evaluation at the bedside since they are portable. We think that this advantage is much more important in the fields such as emergency services and critical care areas where workload is high and time is limited.

Limitations

Considering the limitations, different radiography sets were used in our study. The fact that physicians looked at the same radiographs even on different monitors would increase familiarity with the radiographs. To prevent this, different sets of radiographs were prepared. Although the sets were created from similar radiographs containing the same pathologies by the independent radiology team blinded to the procedures, the difference between the sets may have affected the results.

CONCLUSION

The use of medical monitors by inexperienced medical interns in places such as emergency service where workload is high and time is invaluable will increase the accuracy of diagnosis and decrease the rate of requesting consultation. Additionally, there is not significant difference in radiography evaluation between led monitor and tablet monitor which has the advantages of portability.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was conducted with the Balikesir University Clinical Research Ethic Committee with decision no. 2019/177 and date: 20.11.2019.

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: Study design and data collection: B.C, S.S; Data analysis: B.C; Manuscript preparation: B.C, S.S.

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