

The Evaluation of Teleradiology Images in the Pediatric Emergency Department: A Single-Center Experience

Çocuk Acil Serviste Teleradyoloji Görüntülemelerinin Değerlendirilmesi, Tek Merkez Deneyimi

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Abstract

Background: Teleradiology refers to radiological images being transmitted in an electronic environment from the hospital where the imaging was performed to another center for consultation or reports. It is also widely employed in Turkey. The purpose of this study was to perform a retrospective evaluation of the teleradiology images of patients presenting to the pediatric emergency department.

Materials and Methods: Cases presenting to the pediatric emergency department of a Turkish tertiary education and research hospital between 01.01.2018 and 30.08.2018 and undergoing imaging reported using the teleradiology system were evaluated retrospectively. Age, sex, the imaging technique (computed tomography or magnetic resonance imaging) and the test report result, day and time of presentation to the emergency department, and patient outcomes were recorded.

Results: One hundred nine cases reported with the teleradiology system were included in this study. Forty-four (40.4%) patients were girls and 65 (59.6%) were boys, with a mean age of 105.53 ± 62.46 (4-212) months. Computed tomography was performed on 108 patients (99.1%), and both computed tomography and magnetic resonance imaging on one (0.9%). Patients most frequently presented on Saturdays (22.9%) and at 16:00-00:00 hours (48.6%). The most common emergency department presentation symptoms were those involving the central nervous system (40.4%). Teleradiology system reports were most frequently normal (66.1%), followed by acute appendicitis (11.9%), and hydrocephaly (7.3%).

Conclusions: This first study evaluating the use of teleradiology in the pediatric emergency department concluded that teleradiology is useful in the diagnosis and treatment of cases requiring radiological imaging at the weekends and outside normal working hours.

Key Words: Teleradiology, Pediatric emergency medicine, Computed tomography

Öz.

Amaç: Teleradyoloji hizmeti; radyolojik görüntülemenin elektronik ortamda konsültasyon ya da raporlanması amacıyla ile gönderilmesidir. Ülkemizde de yaygın olarak kullanılmaktadır. Çalışmada çocuk acil servise başvuran hastaların teleradyoloji görüntülemelerinin geriye yönelik değerlendirilmesi amaçlandı.

Materyal ve Metod: Üçüncü Basamak bir Eğitim ve Araştırma Hastanesi Çocuk Acil Servisi'ne 01.01.2018-30.08.2018 tarihleri arasında teleradyoloji sistemi ile raporlanan görüntülemesi olan olgular retrospektif değerlendirildi. Çalışmada; yaş, cinsiyet, görüntüleme tetkiki [bilgisayarlı tomografi (BT) ve magnetik rezonans görüntüleme (MRG)] ve tetkik rapor sonucu, acil servise başvuru günü ve saat aralığı, başvuru şikayeti, hastanın sonlanımı kaydedildi.

Bulgular: Teleradyoloji sistemi ile raporlanan 109 olgu çalışmaya dahil edildi. Olguların 44'ü (%40.4) kız, 65'i (%59.6) erkek, yaş ortalamaları ise 105.53 ± 62.46 (4-212) ay idi. Olguların 108'i (%99,1) bilgisayarlı tomografi, 1 (%0.9) hastaya ise hem bilgisayarlı tomografi hem de manyetik rezonans görüntülemenin yapıldığı saptandı. Olguların hastaneye en sık cumartesi günü (% 22.9) ve 16.00-24.00 (% 48.6) saat aralığında başvurdukları belirlendi. En sık acil servis başvuru şikayeti merkezi sinir sistemine (% 40.4) ait yakınmalar idi. Teleradyoloji sistemi raporları incelendiğinde en sık 3 rapor sonucu; normal (% 66.1), akut apandisit (%11.9), hidrosefali (%7.3) olduğu görüldü.

Sonuç: Ülkemizde teleradyoloji hizmetinin çocuk acil serviste kullanımını değerlendiren bu ilk çalışmada radyolojik görüntüleme ihtiyacı olan olguların tanı ve tedavisinde katkı sağladığı sonucuna varıldı.

Anahtar kelimeler: Teleradyoloji, Çocuk acil tıp, Bilgisayarlı tomografi

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Introduction

Telemedicine is defined as the simultaneous use of medical data and telecommunications technology in medical services and/or for educational purposes (1). Teleradiology, one of the sub-branches of telemedicine, is widely employed in all fields of medicine, and is becoming an increasingly appreciated medical discipline. Teleradiology involves the transmission, via an electronic system, of radiological images from the medical center where the imaging was performed to a different location for interpretation and/or consultation (1,2). The technique first began being used in the 1960s, and teleradiology services in Turkey were first made available in 1997 (2,3).

By their nature, emergency departments are the units most in need of teleradiology. This method plays a key role in the diagnosis, follow-up, and treatment of patients presenting to the emergency department (4). The main factor behind the use of teleradiology in the emergency department is that radiology services are not easily available outside normal working hours (5). No previous studies have investigated the use of teleradiology in pediatric emergency departments in Turkey. The study data will therefore contribute to the literature in clarifying the current position.

The purpose of this study was to perform a retrospective evaluation of cases undergoing radiological imaging in the pediatric emergency department of a tertiary education and research hospital and reported using teleradiology.

Materials and Methods

The files of cases presenting for any reason to the pediatric emergency department of a Turkish education and research hospital between 01.01.2018 and 30.08.2018, undergoing radiological imaging computed tomography (CT) and magnetic resonance imaging (MRI), and with images transferred for reports using the teleradiology service were examined retrospectively. Age (months), sex (male/female), the imaging test requested (CT or MRI) and the test result, the day of presentation to the emergency department, time of presentation, presentation symptom, and outcome (discharge, hospitalization, referral to another hospital department) were recorded from the patient files. Trauma and emergency surgery patients are not examined on a primary basis in our hospital's pediatric emergency department. Trauma and emergency surgery patients are not therefore directly admitted. The surgical requirements of the cases in the study were also assessed separately.

Patients examined in the pediatric emergency department during the study period who did not undergo radiological imaging, and those whose images were not transferred to the teleradiology system despite imaging being performed were excluded from the study.

Ethical approval

Approval was granted by the local ethical committee (no. 2019/8-23).

Statistical Analysis

The study data were analyzed on SPSS software (IBM, version 21.0, Chicago, IL, USA). Categorical data were expressed as number and percentage, and constant variables as mean plus standard deviation.

Results

Examination of the hospital records showed that 116,170 patients were examined at the pediatric emergency department between 01.01.2018 and 31.08.2018. MRI and CT were performed on 120 patients, and images from 109 of these were reported via the teleradiology system. All 109 cases reported using the teleradiology service were included in the study.

Forty-four (40.4%) of the 109 patients in the study were girls and 65 (59.6%) were boys. The mean age of the patients was 105.53 ± 62.46 (4-212) months. CT was performed on 108 (99.1%) patients and CT plus MRI on one (0.9%).

The most frequent day of presentation was Saturday [25 patients (22.9%)], and the most frequent time of presentation was between 16:00 and 00:00 [53 (48.6%)]. Although the most common emergency department presentation symptom was central nervous system findings [50 (40.4%) patients], the incidence of abdominal pain among gastrointestinal system symptoms was also notably high [35 (28.2%) patients]. The data elicited in the study are shown in Table 1.

Table 1: General study data.

		n (%)
Sex	Female	44 (40.4)
	Male	65 (59.6)
Tests	CT	108 (99.1)
	CT and MRI	1 (0.9)
Day of presentation	Monday	14 (12.8)
	Tuesday	12 (11)
	Wednesday	12 (11)
	Thursday	12 (11)
	Friday	23 (21.1)
	Saturday	25 (22.9)
	Sunday	11 (10.1)
Time of presentation	08:00-16:00	39 (35.8)
	16:00-00:00	53 (48.6)
	00:00-08:00	17 (15.6)
Emergency department presentation symptom	Central nervous system	50 (40.4)
	Afebrile convulsion	17 (13.7)
	Febrile convulsion	9 (7.3)
	Headache	8 (6.5)
	Other (clouded consciousness, facial paralysis, syncope, etc.)	16 (12.9)
Emergency department presentation symptom	Gastrointestinal tract	42 (33.8)
	Abdominal pain	35 (28.2)
	Vomiting	7 (5.6)
	General symptoms	32 (25.8)
	Fever	29 (23.4)
	Hematuria	1 (0.8)
	Electric shock	1 (0.8)
Foreign body ingestion	1 (0.8)	

Examination of the CT and MRI reports evaluated through the teleradiology system revealed that 72 (66.1%) were normal, 13 (11.9%) were reported as acute appendicitis, and eight (7.3%) as hydrocephaly. Imaging in the only patient to undergo CT and MRI revealed tubo-ovarian abscess. Details of the teleradiology reports are given in Table 2.

Thirty-eight (34.9%) of the 109 cases included in the study were treated on an out-patient basis, 46 (42.2%) were admitted to the children's diseases ward, and three (2.8%) to the pediatric intensive care unit, while 22 (20.2%) were referred to relevant branch clinics. Sixteen (14.7%) of the patients transferred to relevant branches on the basis on the imaging results were taken for emergency surgery.

Table 2: CT report results.

Diagnosis	n (%)
Normal	72 (66.1)
Hydrocephaly	8 (7.3)
Tubo-ovarian abscess and ovarian cyst	1 (0.9)
Pulmonary mass	1 (0.9)
Ovarian cyst	1 (0.9)
Acute appendicitis	13 (11.)
Arachnoid cyst	2 (1.8)
Cerebral edema	2 (1.8)
Pleural effusion	1 (0.9)
Subdural hematoma	1 (0.9)
Mastoiditis	1 (0.9)
Nasal mass	1 (0.9)
Mesenteric lymphadenitis	1 (0.9)
Perforated appendicitis	1 (0.9)
Acute cerebral ischemia	1 (0.9)
Ureteral stone	2 (1.8)

Discussion

Imaging techniques are of vital importance to rapid and accurate diagnosis in emergency departments. Emergency departments endeavor to meet their radiology consultations, inside or outside working hours, by means of 'teleradiology.' Although there are various models for adult emergency departments across the world, there is no special application for pediatric emergency departments (6,7). Despite the increasing numbers of imaging tests being performed in emergency departments, the problem of insufficient radiology support is predicted to persist in the years ahead. As a result of advances in imaging techniques, and the provision of low-cost imaging archiving and communications systems in rural and less developed regions. Teleradiology is now available on request in all health institutions (3,4). One study evaluating the provision of pediatric radiology services outside normal working hours determined that hospitals approached the subject differently, with models such as shift working, teleradiology services, or a separate radiology unit for the emergency department being employed (6). Teleradiology is also widely employed in rural areas in Turkey (8).

The imaging technique for which reports were most frequently requested in the present study was CT (n: 108, 99.1%). Aquino MR et al. (6) analyzed pediatric emergency department radiology reports outside normal working hours, and reported the use, in decreasing order of frequency, of direct radiology, ultrasound, body CT, and neurological CT. Turgut K et al. (9) analyzed CT images reported by means of teleradiology in pediatric/adult age groups. Those authors established that abdominal CT was the imaging technique for which reports were most frequently requested via teleradiology in cases presenting with abdominal pain. Yurtseven A et al. (10) analyzed CT use in the emergency department and found that 84.2% of 337 pediatric cases undergoing CT imaging were reported as normal. In the present study, 66.1% of CT tests were reported as normal. Considering that gastrointestinal tract symptoms were present in 42 (33.8%) of the 109 cases included in this study, and the numbers of reports determining abdominal pathology from CT examination and of cases reported as normal (Table 2), we think that greater priority should be attached to alternative imaging techniques not involving radiation (such as ultrasonography), as an alternative to CT imaging.

Gattu et al. (11) examined the literature concerning telemedicine practices (tele-consultation, tele-monitoring, tele-education, etc.) in pediatric emergency medicine in a study from 2016. Those authors reported that the use of telemedicine procedures in pediatric emergency medicine was promising, and that the number of academic centers using telemedicine programs was rising on a continuous basis. The present study is the first to evaluate teleradiology services in the pediatric emergency department in Turkey. Our study data show that teleradiology is most employed on Saturdays and between the hours of 16:00 and 00:00. They also show that hospitals requesting teleradiology service provision or already using teleradiology will experience or are experiencing greater intensity on the day and times we identified for pediatric emergency departments.

In addition to providing immediate information, teleradiology can also prevent repeated test requirements when properly planned. In a retrospective study from the USA in 2016, Watson et al. (12) analyzed 400 randomly selected trauma patients transferred to the surgery department of a university hospital in 2007-2012. These consisted of 200 trauma patients admitted without use of teleradiology and 200 admitted after teleradiology services. The authors concluded that repeat CT imaging rates were lower in the trauma patient group admitted after use of teleradiology. That study also suggested that teleradiology reduced costs, length of stay in the emergency department, and exposure to radiation. Trauma patients are not admitted to our pediatric emergency department. However, it appears that the need for repeated CT imaging can be prevented as a result of teleradiology for cases requiring surgery. In a study from 2008, Duchesne et al. (13) analyzed the application of teleradiology in the care and management of trauma patients in a rural area.

The authors reported that as a result of teleradiology use, severely injured patients were transferred promptly to a tertiary trauma center. That study indicated that with the use of telemedicine, patients with mild injuries could be treated in the center without being referred to an advanced center, and that repeated CT scans were avoided in the event of referral. The analyses described above and our own study results indicate that the use of teleradiology should be further disseminated in pediatric emergency departments.

Limitations

The limitations of this study include its single-center nature, and the low patient number deriving from the fact that ours is not a trauma/emergency surgery center.

Conclusions

Teleradiology is successfully employed in the pediatric emergency department and contributes significantly to the diagnosis and treatment of cases requiring radiological imaging. Further studies regarding teleradiology in the pediatric emergency department are now needed.

Ethical Approval: Approval was granted by the local ethical committee (no. 2019/8-23).

Author Contributions:

Concept: IHB, HA

Literature Review: IHB, SOT, HA

Design : IHB, SOT, MT

Data acquisition: IHB, SOT

Analysis and interpretation: SOT, HA

Writing manuscript: IHB, MT

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