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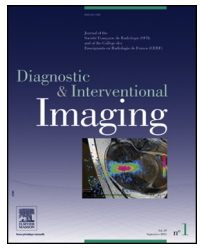

ORIGINAL ARTICLE /*Professional information*

Addressing requests for emergency ultrasonographic examinations when implementing teleradiology services

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Abstract
Purpose: To prospectively assess how to address requests for ultrasonographic examinations when setting up an on-call teleradiology service.
Materials and methods: An analytical prospective study was performed from January 2012 to December 2012 inclusively. All requests received for after-hours ultrasonographic examinations during this period were analyzed. Ultrasound requests were classified as being postponable until working hours, replaceable by an alternate cross-sectional imaging modality, or urgent and needing to be performed after hours.
Results: A total of 176 requests for ultrasonographic examinations were analyzed. They predominantly included requests for abdominal and pelvic ultrasonographic examinations (63%). Thirty-nine requests (22.2%) were considered as postponable, 49 (27.8%) as replaceable and 64 (36.4%) as both postponable and replaceable. Twenty-four requests (13.6%) were considered as urgent; they consisted of 10 requests for venous duplex Doppler ultrasonographic examinations of the lower limbs, eight requests for testicular ultrasonographic examinations, five for pelvic ultrasonographic examinations and one for soft-tissue ultrasonographic examination. In these urgent cases, realistic options were either to transfer the patient to another institution or to train emergency department physicians in ultrasonography for local handling.
Conclusion: Although the need for addressing requests for ultrasonographic examinations should be taken into account when setting up an on-call teleradiology service, it should not impede such plans.

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The number of requests for imaging studies has significantly increased over the last few years, particularly those arising from emergency departments [1]. In the same time, the number of practicing radiologists is markedly insufficient in France. Some regions, such as Lorraine, are particularly affected by the lack of such specialists. In 2012, 13% of the 263 radiologists practicing in Lorraine were older than 65 year-old [2]. In light of this, the importance of teleradiology services continues to increase in order to guarantee a 24-hours a day and seven days a week access to imaging evaluation [3]. In the Lorraine region, a teleradiology project was initiated in 2008 and has been under evaluation since 2010 [4]. It is planned that our hospital will handle, jointly with the Metz-Thionville University Hospital Center, an on-call teleradiology service from 2014 on.

The question of handling requests related to ultrasonographic examinations arose when considering how to successfully implement an on-call service for interpretation of remotely acquired imaging examinations. In effect, if the on-duty or on-call radiologists are replaced by a regional on-call teleradiology service, then a radiologist will no longer be able to physically perform on-site and bedside ultrasonographic examinations.

Bearing this in mind, we decided to assess all the after-hours requests for ultrasonographic examinations received in our hospital over a year period. The main objective of this study was to determine whether after-hours ultrasonographic examinations are actually indispensable. The secondary objective was to determine in which situations emergency ultrasonographic examinations are essential and to consider what solutions would be appropriate to handle such cases.

Materials and methods

An analytical prospective study was performed by the medical imaging service of the Hôpital d'Instruction-des-Armées Legouest in Metz, France over a one-year period spanning from 1st January to 31st December 2012 inclusively. Due to the solely observational nature of the study, patients' signed consent was not required.

Patient selection

This study reviewed all requests for ultrasonographic examinations received after hours in 2012 by our medical imaging service. Our service is part of a 200-bed general hospital with no pediatric, gynecological or obstetrics departments but an emergency department that received 21,672 patients in 2012. Because there is no pediatric activity, all patients referred for ultrasonographic examinations were at least 15 years and three months old.

Requests were considered as ''after-hours'' if received from 6 pm to 8 am on weekdays, and 24/24 on Saturdays, Sundays and national holidays.

Exclusion criteria were ultrasound examinations requested by radiologists in addition to other imaging modalities or ultrasonography performed during surgical draining procedures.

Questionnaire

Every request for ultrasonographic examination was recorded by the on-duty radiologist using a dedicated data collection form.

A first section focused on recording patient demographics and included gender, age, and department that issued the request. The form then contained free-text fields in which the radiologist could record data about the indication for the requested ultrasonographic examination: clinical examination, laboratory results and diagnostic hypotheses. The third part of the form was used to record data about the imaging procedure performed: type of imaging examination requested, examination actually performed and time between request and examination.

Data analysis

All questionnaires were analyzed by a medical imaging resident (C.J.L., sixth semester) and a senior radiologist with eight years' experience (A.G.). The requests were first analyzed to determine the maximum time between the request and ultrasonographic examination for each indication and to ensure that good radiology practices had been observed (as laid down by the French Society of Radiology in *Guide du bon usage des examens d'imagerie médicale* [Guidelines for proper use of medical imaging] amended in 2013 [5] and *Guide des indications d'imagerie pour les urgences de l'adulte* [Guidelines for indications for emergency imaging in adults] in 2004 [6]).

To ensure that our cases were properly correlated within these guidelines, disease criteria were established by an expert committee comprising an emergency clinician, an intensive care doctor, a general surgeon, an orthopedic surgeon, a gastroenterologist, an internist and a radiologist.

These disease criteria were also used to sort cases based on severity: severe sepsis or intensive care for abdominal infection (cholecystitis, pyelonephritis), concurrent pregnancy or renal failure for pyelonephritis, renal failure, single kidney or fever in cases of suspected renal colic.

Depending on both the indication and the guidelines, each request was assigned to one of the three following categories:

- postponable until working hours;
- replaceable by an alternative slice imaging modality;
- urgent (i.e. not postponable), not replaceable and needing to be performed after hours.

The replaceability of requests for ultrasound was first determined strictly based on good radiology practices, then, as a second step, by extending replacement indications to computer tomography (CT) examination and/or magnetic resonance imaging (MRI), without nevertheless diminishing diagnostic quality.

Data collection

The number of CT and MRI examinations performed after hours in our medical imaging service over the whole inclusion period was collected retrospectively from the Picture Archiving and Communication System (PACS) archiving