The Role of Current Emergency Radiology Practice: A prospective Cross-sectional Study Done at Tikur Anbessa Specialized Hospital

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Background: ***The role of radiogy in the management of emergency patients is tremendous. Which imaging modality best evaluates specific clinical emergencies has evolved and continues to advance with clinical practice trends. The purpose of this study was to show the role of radiology in emergency patient handeling and compare specific clinical entities with the standard.***
Methods: ***A prospective cross sectional study was done to describe the pattern of duty hour emergency utilization at Tikur Anbessa Hospital Department of Radiology. A total of 384 patient's data were collected for the period of Jananuary 1st to April 30th 2010. The data which were demographic variables, clinical diagnosis, radiologic diagnosis, type of investigation used, type of anatomic area imaged, whether primary investigation used or not, recommendations made by the radiology residents were collected and tabulated.***
Results: ***There were 242 (63%) males and 142 (37%) females. Suspected fracture was the commonest clinical indication for referring patients to the department of radiology at the duty hours and accounted for 40.9% of all cases. Otherclinical diagnoses included pnumonia (21.6%), blunt abdominal trauma (5.7%) and pulmonary edema (4.7%). Plain radiographs were taken in 88% of patients sent for imaging. Among the sonographic studies done, 43.4% were for patients presenting with blunt abdominal trauma. Of all patients in 90.4% primary investigative modalities were used. Comparison of clinical and radiologic diagnosis was made in most common clinical cases and in general 51.3% of radiologic interpretations were normal.***
Conclusion: ***Plain radiography was used as the cornerstone investigative modality for emergency imaging. Fracture and pneumonia constituted the commonest indications for emergency imaging in all age groups. Over half of radiologic investigations were normal. It was observed that lack of appropriate investigative modalities such as CT scan, doppler and high frequency ultrasonography greatly affected the quality of service the department offered and also negatively affected the training process.***

Key words: Emergency, Radiology, Practice

Introduction

Emergency in medicine is defined as a patient's condition requiring immediate treatment. Since 1895, Wilhelm Roentgen discovered x-rays; the field of medicine has been revolutionized. The role of radiology on emergency is tremendous in both diagnostic and therapeutic aspects. Although many modifications of diagnostic imaging have since been developed (eg Ultra sound, Computed Tomography , Magnetic Resonance Imaging), plain radiography continues to play a role in diagnostic radiology for emergency medicine. With continued study and research there are evidenced primary investigative modalities for specific area of concern. Computed Tomography (CT) scanning is used in the emergency evaluation of traumatic and non traumatic disorders of the CNS and abdomen, ultrasongraphy can be used for the commonly called the six specific cases (cholecystitis, hydronephrosis, abdominal aortic aneurysm, pregnancy related conditions, hemoperitoneum and pericardial effusion)[1]. However, ultrasound can also provide complete evaluation of the abdominal organs, and also can be used to diagnose appendicitis, pelvic studies, scrotal imaging especially when it is aided with Doppler examination.

MRI has a tremendous role in the emergency evaluation of acute spinal cord compression and occult femoral neck fracture. Although MRI has quite a superior soft tissue resolution and generate images in any anatomic plane than CT, because it takes much longer time it's not usually used as a primary imaging modality at the emergency unit.

It's not until the year 2008 that the department of Radiology, medical faculty at Tikur Anbessa Hospital has started offering duty hour Radiology service making it yet the only one in the country to start such a program. Although the input that the department has in the facilitation of the duty hour emergency case handling is not debatable, it's important to analyze and measure the impact it has made and judge the standard and quality of service it is offering. Thus, this study is expected to show the pattern of emergency cases sent to the department of radiology at duty hours with assessment of the imaging modalities and standardness of service by comparing with pre existing data. This study can be used as a platform for future planning and implementation of actions the department plans.

Patients and Methods

This is a prospective cross sectional study done to analyze emergency cases seen at the Department of Radiology, Tikur Anbessa Hospital at the duty hours, on the period of Jan 01- Apr 30, 2010. All patients sent to the Department of Radiology during the duty hours within in a period from Jan 1-Apr 30, 2010 were included in the study. Patients with no written clinical history and incomplete demographic information were excluded from the study. Since no previous study was done in Ethiopia, sample size was calculated using a single proportion method taking the margin of error to be 0.5, confidence interval 95% and P = 50%. The calculated sample size was 384. Samples were taken on consecutive day bases and all patients who are sent to the department during the specified period were included until the calculated sample size was achieved.

A structured questionnaire was was used for data collection. Data was collected by the final year radiology residents and the investigators were supervising the data collection process. The study used the available sociodemographic variables, the clinical and radiological diagnosis; the region of the body underwent imaging evaluation and the use of standard primary imaging modalities. Data cleaning was made manually during data collection daily after collection and electronically following completion of the data entry. Data entry was done using a Statistical Package for Social Sciences (SPSS) version 15.0. Data was presented using graphs, charts and frequency tables. Chi-square test was used for testing statistical significance of the comparison of trauma between males and females. Ethical clearance to undertake the research was obtained from the research and ethical commitee of the department.

Results

Patients with the age range of one hour old to 90 yrs of age seen in the study with the mean age of 29 yrs, SD:17.2. More than half of the cases seen were between age of 20-49years. Among the 384 patients 242 (63%) were males and the rest (37%) were females. Over all, suspected fracture (40.9%) and pneumonia (21.6%) constitute 62.5% of all clinical cases sent for imaging (Figure.1). Overall traumatic emergencies account more than half (52.6%) of patients sent for imaging of which 72.7% are males. Orthopedic (44.8%), medical (31.5%) and surgical (20.3%) cases constitute 96.6% of all cases sent for imaging. In patients less than 10 yrs old pneumonia is found as the commonest clinical indication (41%) for imaging (Table 1). Fracture is the commonest clinical indication (47.9%) males present for imaging while females appear most with suspected pneumonia (31.6%) during the duty hour. The occurrence of imaging in trauma patients is seen to be higher in males than females (OR 2.4, CI 1.6-3.7).

Plain radiography is the most commonly used imaging modality (88%) and the rest were sonographies. Among the sonographies done, 43.4% were for patients presented with blunt abdominal trauma. Chest imaging constitute the most commonly imaged area (37%) for which plain radiography (CXR) is used in all cases (Figure. 2). Chest (37%), musculoskeletal (20.3%), abdominal (16.7%) and skull (16.7%) make 90.6% of all the imagings done. Among the abdominal imagings 60.9% used ultrasonography and 39.1% were plain abdominal radiographs. All skull and cervical imagings used radiograph (Figure. 3).

Table 1. Distribution of common clinical diagnosis with specific age ranges & use of primary imaging modality at Tikur Anbessa Hospital from Jananuary to April, 2010.

Age range (yrs)	Clinical Diagnosis						Total
	Fracture	**pneumonia**	**Pulmonary edema**	**Intestinal obstruction**	**Blunt Abdominal Trauma**	Others	**Total**
<10	13	23	3	5	1	11	56
10-19	32	4	2	1	3	10	52
20-29	50	25	6	0	8	24	113
30-39	24	15	2	1	6	21	69
40-49	14	6	4	2	0	8	34
50-59	15	3	1	4	3	8	34
60-69	8	4	0	3	1	5	21
>70	1	3	0	1	0	0	5
Total	**157**	**83**	**18**	**17**	**22**	**87**	**384**
Use of Primary Imaging Modality							
Yes	150	83	18	16	2	78	347
No	7	0	0	1	20	9	37
Total	**157**	**83**	**18**	**17**	**22**	**87**	**384**

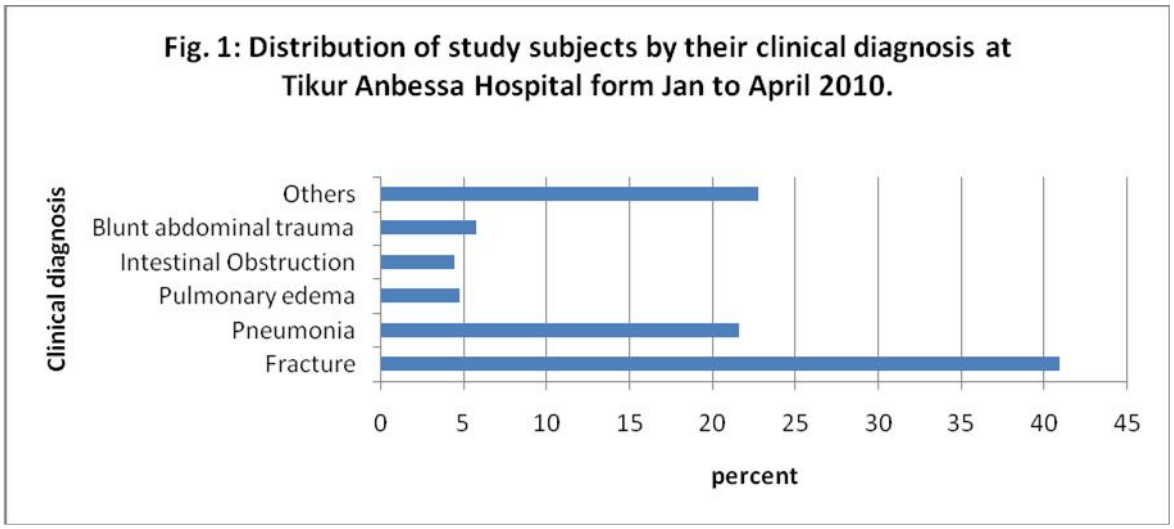
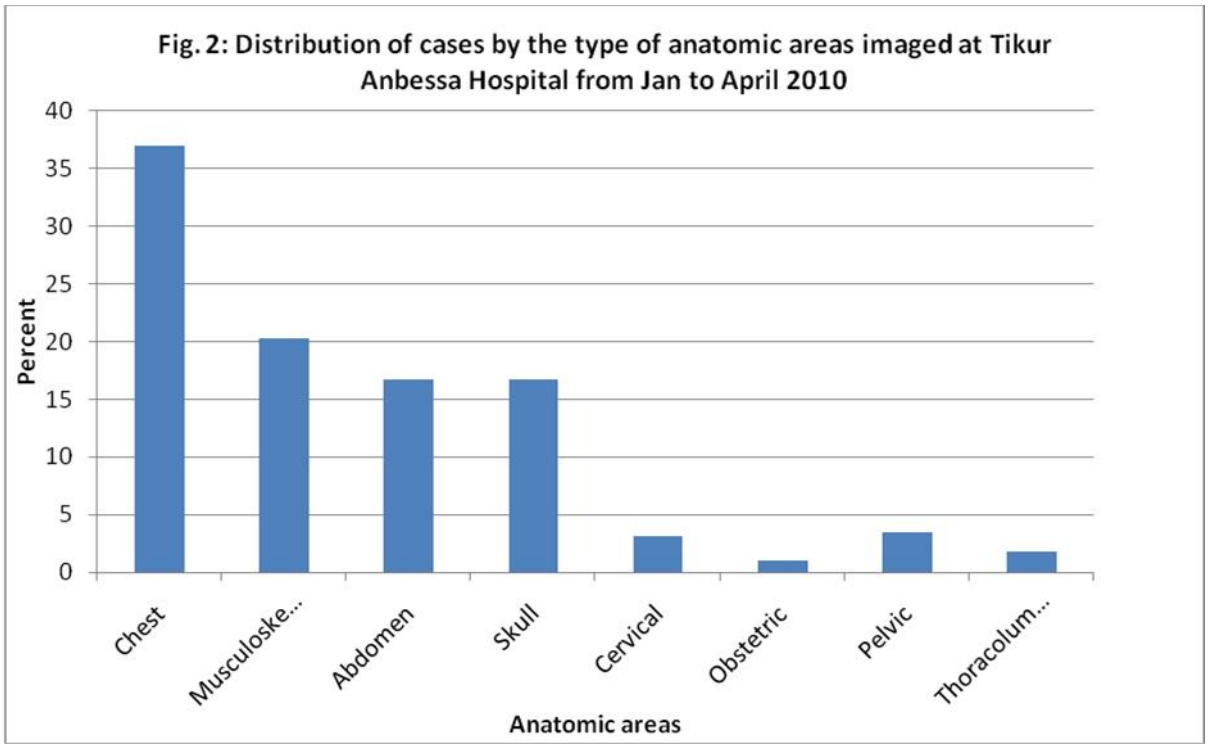
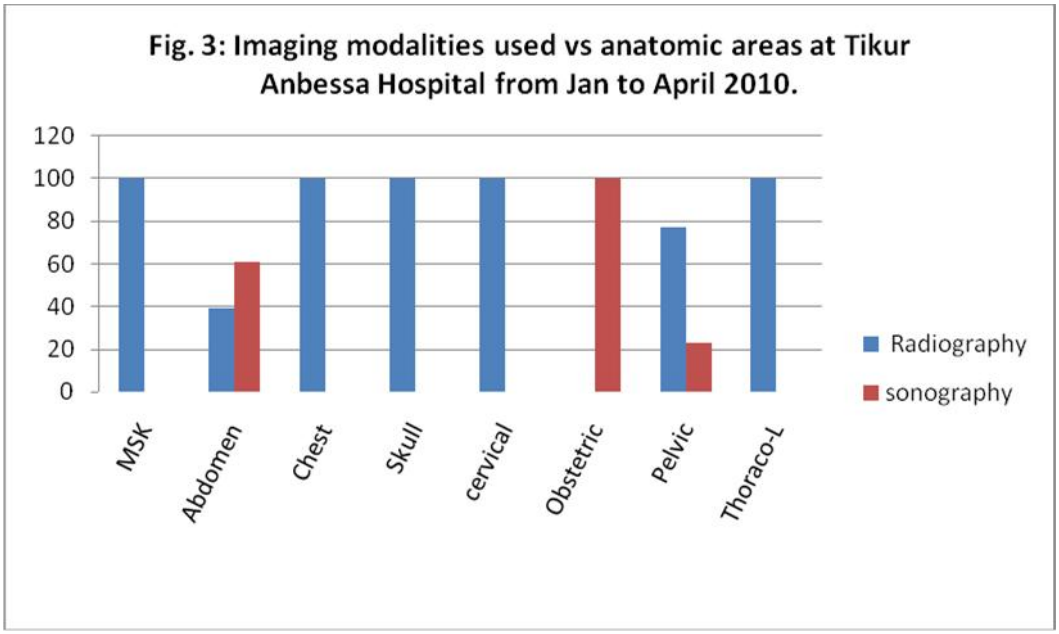


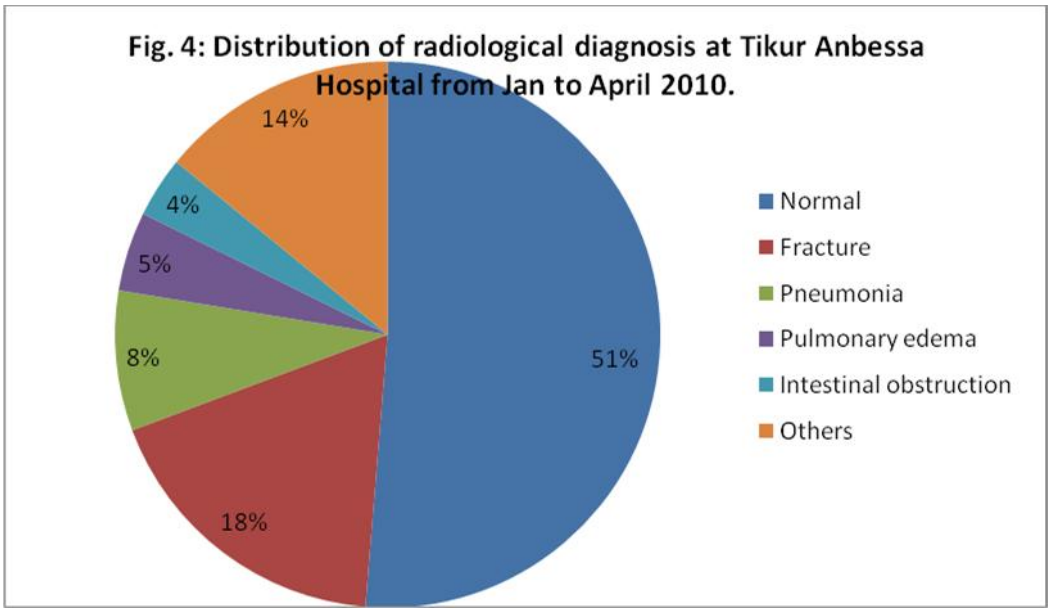
Table 2. Distribution of findings in common clinical and radiological diagnosis at Tikur Anbessa Hospital from January to April, 2010.

Clinical Diagnosis	Radiological Diagnosis						Total
	Normal	Fracture	Pneumonia	Pulmonary Edema	Intestinal Obstruction	Others	
Fracture	88	66	0	0	0	3	157
Pneumonia	40	0	29	7	0	7	83
Pulmonary edema	4	0	1	11	0	2	18
Intestinal Obstruction	3	0	0	0	12	2	17
Blunt abdominal Trauma	20	0	0	0	0	2	22
Others	42	3	2	0	2	38	87
Total	197	69	32	18	14	54	384



90.4% of all the imagings done used primary investigative modality for the specific clinical diagnosis. Of patients sent for imaging with the clinical diagnosis of blunt abdominal trauma ultrasonography was done for 20 of 22 patients even if in all it was not the primary investigative modality as to the standard of practice (Table 1).





Normal radiologic diagnosis is found out to be the commonest finding (51.3%) in all patients sent at the duty hour (Figure 4). Among patients sent with clinical diagnosis of fracture 56.0% had normal radiologic interpretation otherwise, the remaining had fracture and in only 1.9% an alternative diagnosis of dislocation was made. Of patients sent with the diagnosis of pneumonia 48.2% had normal chest x-ray findings while in 34.9% radiologic investigation confirmed the clinical diagnosis. Radiologic diagnosis of pulmonary edema was made in 8.4% of patients sent with clinical assessment of pneumonia. In patients sent with clinical diagnosis of blunt abdominal trauma 90.9% had a normal radiologic finding (Table 2). Of all the 384 patients studied 20 recommendations were made by the duty radiology residents. CT scan was recommended in16 of the 20 cases (80%).

Discussion

Eventhough there are no prior studies done at TAH or in Ethiopia showing the pattern of emergency radiologic investigations, studies in other countries show significant number of emergency cases undergo radiologic investigations[2,3]. In our series fracture and pneumonia were found out to be the commonest clinical indications for emergency imaging at the duty hour. The higher proportion of emergency imaging for fracture can have various reasons however; the fact that road traffic accident is still among the commonest causes of morbidity and mortality in the country may contribute a significant share of the picture. Even emergency admissions comprise more than one third of total surgical admissions in our setup[4].

Overall traumatic cases out number non traumatic cases at emergency imaging. Although factors for this should further be studied, medico legal reason for imagings of almost all traumatic cases and the lack of appropriate images modalities for non traumatic patients which can lead physicians for absolute clinical decisions are probable contributing factors.

The tremendous role and diagnostic advantage of plain radiography in the assessment of musculoskeletal trauma, chest abnormalities like pneumonia and pulmonary edema, intestinal obstruction and pneumoperitoneum is seen in this series as has been repeatedly confirmed in other studies. Although plain radiography has such a role, it is emphasized that it should not be used indiscriminately in undifferentiated patients presenting with abdominal pain [5-8]. In our study proper usage of plain abdominal radiograph which was mostly utilized for patients with intestinal obstruction is observed.

The vast advantage of emergency ultrasonography imaging was not seen in our study and its use was limited to fewer cases. Even if the vast improvement in both hard ware and soft ware components of ultrasonography significantly changed the diagnostic capability of the machines[9], we are currently using mobile grey scale fixed frequency probs in the hospital the study is conducted. So despite its tremendous role in the evaluation of hydronephrosis, hemoperitoneum, pericardial and pleural effusion[10-13], its role was seen to be unutilized in our setting. In general in this series the utility of ultrasonography was found to be limited to abdominal and pelvic imagings and insignificant or nil sonographic applications of chest trauma, pericardial effusions, acute appendicitis, testicular torsion and ectopic pregnancy. The lack of appropriate ultrasonographic machines for specific clinical cases may lead to absolute clinical decisions made by physicians however factors for limited utilization of the available machine should further be studied. Moreover, duty hour imaging interpretation and ultrasonographic service has been established as a program in the department recently as compared with other departments and this new trend in the emergency patient handling may partly explain the under utilization.

Which clinical emergencies are best evaluated by ultrasonography has evolved and continues to evolve with clinical practice trends. Some of the thoughts regarding which emergency situations are best evaluated by ultrasonography and which are not are also affected by local clinical customs and workup methods as well as the practicalities of available machinery and staff. Even if there is a controversy as to the use of ultrasonography in traumatic case as primary investigative modality[14-17]. It has a great role for both traumatic and non traumatic cases presenting for imaging[11-13]. It has a higher degree of sensitivity in identifying fluid collection (pleural, pericardial and peritoneal), obstetric complications, acute appendicitis, testicular torsion[10-13,18-21]. However its advantage could only be achieved with proper instrumentation and adequate skill. In the current set up of the department of radiology at TAH only a 3.5MHz B-mode ultrasonography is available and this significantly limits the type of emergency patients seen at the department. Blunt abdominal trauma is the single most common indication for ultrasonography in our series however in all cases no positive finding could be detected and this can partly be attributed to the low sensitivity of ultrasonography.

Primary investigative modality was used in the majority of emergency cases seen at the duty hour. This high rate utility explain only patients who benefit from the available investigative modalities were sent for imaging otherwise those who need other investigative modalities like CT,high frequency ultrasonography, doppler examinations would not be sent to the department of Radiology.

About half of the radiologic diagnosis turned out to be normal. This significant turn out could have various reasons; medicolegal reason for imaging could be one factor. Other factors related to adequate clinical assessment and radiologic interpretation which may explain the mismatch should further be studied. CT was suggested in most of the recommendations when the available investigative modalities made specific clinical cases inconclusive. Even if routine CT scanning for all patients with skull fracture having normal neurologic finding has not shown to have a change in the management or the clinical outcome of patients[22]. It has a high sensitivity and specificity in identifying the cause of abdominal pain in patients with non traumatic abdominal pain presenting to the emergency department. It has also a higher accuracy in identifying solid and hollow organ injury, type and source of fluid collection, cause of intestinal obstruction[16, 17, 23]. The lack of this investigative modality greatly affects the quality of service the department is currently offering and aswell being the only post graduate Radiologic training school in the country, the lack of such basic investigative modalities greatly affects the teaching process.

Because of the unavailability of imaging modalities other than plain radiography and 3.5MHz B-mode mobile ultrasonography, only selected patients who benefit from these modalities were sent to the department of radiology. This has limited the number and type of patients sent to the department and put bias on the patterns of emergency conditions in our setup

Conclusion

Plain radiography was found out to be the cornerstone investigative modality for emergency patients. Fracture and pneumonia were the common clinical indications for imaging in all age groups. For majority of emergency cases primary investigative modality was used. Normal radiologic diagnosis was made in marginally higher cases; in the rest clinical diagnosis was confirmed or alternative diagnosis was suggested.

The absence of other imaging modalitie which are crucial for the imaging workup of emergency cases, like ultrasound having linear, echo and endovaginal probes and Doppler facilities and CT-scanner, greatly affected the initial optimal evaluation and further workup of emmeregency cases. So as the pioneer and the only central specialized hospital of the country, the authors strongly recommend to make these things available in the setup to have an optimal and complete imaging evaluation for emmeregency cases.

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