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ARAŞTIRMA / RESEARCH

Changes in imaging patterns of geriatric trauma patients in emergency department

Acil serviste geriatrik travma hastalarının görüntüleme örüntülerindeki değişiklikler

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Abstract

Purpose: We aimed to analyze imaging tests and findings in a series of geriatric trauma patients admitted to emergency department (ED) at different time intervals.
Materials and Methods: Two groups of 300 randomly selected patients over consecutive five-year periods were compared. Patients admitted in the first and second five-year periods were recorded as group I and II, respectively. A comprehensive comparison was carried out between two groups regarding the age, sex, reason for admission, comorbidities, Revised Trauma Score (RTS), Glasgow Coma Scale (GCS), radiological findings and number of radiological examinations, dose length product (DLP) values and duration of hospital stay.
Results: The number of patients who underwent X-ray and CT examinations and total number of X-rays and CT scans in group II was higher than those in group I. CT scans were negative for a trauma-related finding in 49% of patients in group I and 55% of patients in group II. In patients with radiological evidence of trauma, no significant difference was observed between two groups regarding the major trauma related change. However, the trauma-related minor findings on CT were more common in group II than in group I.
Conclusion: Despite the increasing use of imaging tests, there was no difference in imaging findings suggesting major trauma or requiring a longer inpatient stay. This may be related to the increasing use of radiological examinations over the years as a result of the orientation towards defensive medicine.
Keywords:. Emergency Service, Hospital, computed tomography, trauma, geriatric, defensive practice, imaging

Öz

Amaç: Bu çalışmada, acil servise başvuran geriatrik travma hastalarının görüntüleme tetkikleri ve bulgularını analiz etmeyi amaçlanmıştır.
Gereç ve Yöntem: Ardışık beş yıllık periyotlarda, rastgele seçilen 300 hastalık iki grup karşılaştırıldı. Birinci ve ikinci beş yıllık dönemde başvuran hastalar sırasıyla grup I ve II olarak kaydedildi. Her iki grup yaş, cinsiyet, başvuru nedeni, komorbidite, Revize Travma Skoru (RTS), Glasgow Koma Skalası (GKS), radyolojik bulgular ve radyolojik inceleme sayısı, Doz-Uzunluk Çarpımı değerleri ve hastanede kalış süresi açısından detaylı olarak incelendi ve gruplar arası karşılaştırma yapıldı.
Bulgular: Grup II'de direkt grafi ve BT tetkiki yapılan hasta sayısı ile toplam grafi ve BT tetkiki sayısı grup I'e göre daha fazlaydı. BT taramaları, grup I'deki hastaların %49'unda ve grup II'deki hastaların %55'inde travma ile ilişkili bulgular açısından negatifti. Travma ile ilişkili radyolojik bulguları olan hastalarda, travmaya bağlı majör bulgular açısından gruplar arasında anlamlı bir fark gözlenmedi. Ancak, BT'de travmaya bağlı minör bulgular grup II'de daha sıktı.
Sonuç: Görüntüleme testlerinin istenme oranı zaman içerisinde artmış olsa da, majör travmayı düşündüren veya daha uzun yatış gerektiren görüntüleme bulguları açısından gruplar arasında fark saptanmadı. Bu durum, defansif tıbba yönelimin bir sonucu olarak yıllar içinde artmış radyolojik tetkik kullanımı ile ilişkili olabilir.

Anahtar kelimeler: Acil servis, bilgisayarlı tomografi, travma, geriatri, defansif tıp, görüntüleme

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INTRODUCTION

Along with the aging population worldwide, a proportional increase has been observed in the number of morbidity and mortality due to geriatric trauma and the burden on health care services experienced accordingly. The effect of trauma on geriatric population (>65y) may differ compared to younger age groups due to the aging associated physiological and metabolic changes, need for anticoagulation therapy, and presence of comorbid diseases that may be experienced by older population[1-4]. Advanced age becomes a significant risk factor for trauma related morbidity and mortality.

Computed tomography (CT) has replaced conventional radiography and ultrasonography due to its capabilities for rapid and accurate assessment of trauma patients. Overcrowding in emergency departments and physicians' fear of malpractice resulted in increased and unnecessary requests for imaging tests, which consequently increased burden on healthcare costs and workload of radiology departments[5-8].

First goal of the present study was to analyze the imaging findings in a series of geriatric trauma patients admitted to our emergency department (ED) over consecutive five-year periods. Second goal was to find out whether incidence of trauma induced pathologies or the need for imaging have changed over the years.

MATERIALS AND METHODS

Study design and setting

Two groups of 300 randomly selected geriatric (≥65 years) trauma patients admitted to Hacettepe University Hospitals, department of emergency medicine over consecutive five-year periods were compared. Patients admitted during the first (2006-2011) and second (2012-2017) five-year period were recorded as group I(300 of 597) and II(300 of 987), respectively. Medical records, X-rays and CT examinations of these patients were reviewed (were done by EG) thoroughly to accomplish the goals of the current study. In our hospital, the medical records and radiology reports are archived electronically in the hospital information system. And, the imaging studies are archived electronically in picture archiving and communication system (PACS). This retrospective study has been approved by the local ethics committee (Hacettepe University, Non-Invasive Clinical Research Ethics Committee, GO 17/99-08). Informed consent was waived because of the retrospective nature of the study.

A comprehensive comparison was carried out between two groups regarding the age, sex, reason for admission, associated comorbidities, Revised Trauma Score (RTS), Glasgow Coma Scale (GCS), imaging findings and number of radiological examinations, dose length product (DLP) values, major and minor findings in trauma, duration of hospital stay, and trauma associated morbidity and mortality. Correlation between the GCS and the number of CT scans was also evaluated in two groups. CT examinations were performed with a two-detector CT (Somatom Emotion Duo, Siemens Medical Systems, Germany) scanner.

Statistical analysis

Statistical Package for Social Sciences (SPSS) version 21.0 (Chicago, IL, USA) was used for the statistical analysis. T-test for normally distributed variables and Mann-Whitney U test for ordinal variables was used. Chi-square test was utilized for the comparison of categorical variables. Descriptive statistics were given as median (minimum – maximum) and mean ± standard deviation. Categorical variables were provided as frequencies and percentages. A p-value less than 0.05 was considered significant.

RESULTS

There were no significant differences between two groups regarding the age and sex (p=0.073) (Table 1). Approximately 90% of patients in both groups had at least one of the chronic diseases such as hypertension, coronary artery disease, or diabetes mellitus. There was no significant difference between the two groups in terms of the DLP values for CT examination of each body part (p>0.05) (Table2).

Fallings were the most common cause for admission in both groups, followed by traffic accidents. In general, RTS and GCS values were similar in both groups (p>0.05). However, the difference between two groups for GCS values of the patients who underwent CT scan was significant (14.84± 1.21 in group II vs. 14.53± 1.96 in group I; p=0.003) (Table 3).

Table 1. Patients' demographics

	Group I	Group II
Number of patients	300	300
Age	76.6 (66-106) years	78.5 (67-98) years
Female n (%)	201 (66.8%)	162 (54%)
Male n (%)	99 (33.2%)	138 (46%)

Table 2. Dose length product (DLP) values for both groups.

Examined body part	Mean DLP Group I	Mean DLP Group II	P value
Brain	689.9	667.7	0.065
Cervical spine	53.6	49.6	0.081
Thorax	261.4	253.4	0.079
Maxillofacial	125.1	124.8	0.092
Abdomen	418.4	420.5	0.098
Orbita	92.6	97.9	0.091
Lomber spine	106.9	103.2	0.087
Thoracic spine	139.3	118.3	0.071
Pelvis	181.3	162.6	0.072
Shoulder	97.9	96.8	0.076
Hip	118.6	104.5	0.069
CT angiography	381.3	360.4	0.073
Paranasal sinuses	128.6	132.5	0.083

Table 3. Revised Trauma Score (RTS) and Glasgow Coma Scale (GCS) in both groups.

	Group I	Group II	P value
RTS*	7.76 ± 0.62 (median=7.841)	7.81 ± 0.68 (median=7.941)	p>0.05
GCS*	14.82 ± 1.26 (median=15)	14.97 ± 1.28 (median=15)	p>0.05
RTS**	7.62± 1.17	7.75± 1.25	p=0.64
GCS**	14.53± 1.96	14.84± 1.21	p=0.003

*=all patients in an individual group. **=patients who underwent to CT scan in an individual group

Table 4. Length of stay in both groups.

	Group I	Group II	P value
Emergency Department Length of Stay	mean 1.5 day (1-12 day)	mean 1.5 day (1-9 day)	p=0.122
Length of Hospital Stay	mean 4 day (1-146 day)	mean 5 day (1-112 day)	p=0.139

Table 5. Trauma-related minor findings on CT scan

	Group I (n)(219[a])	Group II (n)(409[a])
Cephalohematoma	9	21
Nasal bone fracture	6	10
Nondepressed skull fracture	2	7
Nondisplaced rib fracture	2	4
Grade I* splenic laceration	2	3

*= subcapsular hematoma affecting <10% of laceration surface, laceration <1 cm

[a] number of CT exam

There was no significant difference between the two groups in terms of length of stay (table 4) in the emergency department (p=0.122) and mortality rates (p=0.135). The number of patients who underwent X-ray and CT examination in group II was higher than in group I (89% vs 82%, 73% vs 44%, respectively, p= 0, 516, p=0.021 respectively). The total number of X-rays and CT scans was also higher in group II than in group I (613 vs 310, 409 vs 142, respectively, p= 0, 014, p=0.01 respectively) (Fig 1).

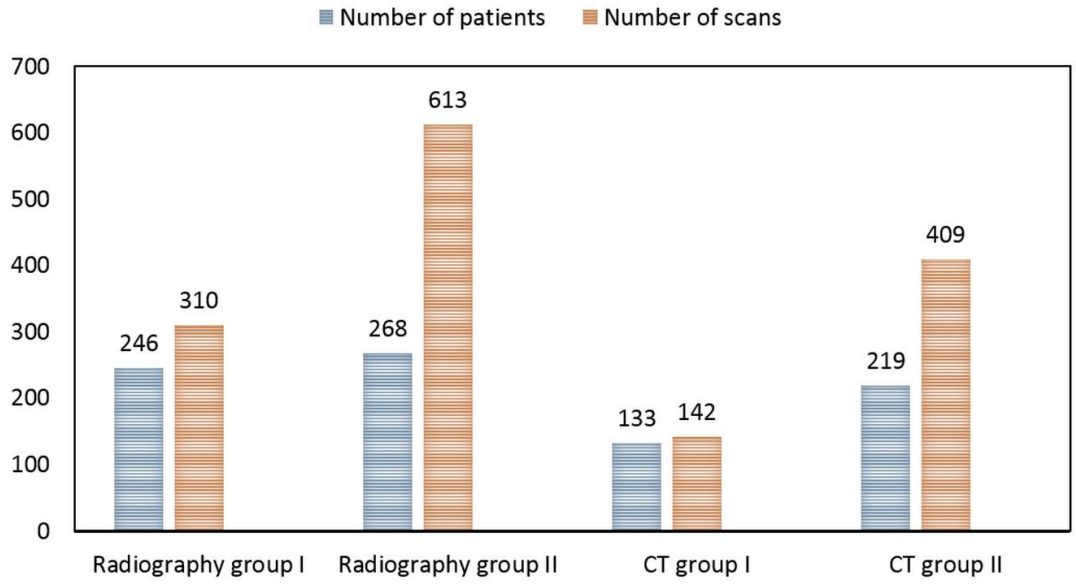

Figure 1. The bar plot shows the difference between both groups regarding radiological examinations. In each group, the number of patients and the number of examinations are shown, and some patients have more than one examination.

Table 6. Incidental CT findings

	Group I (n) (142[a])	Group II (n) (409[a])
Lung nodule	5	9
Meningioma	2	5
Abdominal aortic aneurysm	2	4
Hydatid disease	0	1
Hydrocephalus	0	1
Chronic subdural hematoma	1	3

[a] number of CT exam

In 49% of the patients in group I and 55% of the patients in group II, radiological finding related to trauma were not detected in CT examinations. In patients with radiological evidence of trauma, there was no significant difference between two groups regarding major trauma related pathologies (p=0.151). However, trauma-related minor findings on CT scan (without emergent or urgent indication for surgery) were more common in group II than in group I (p=0.031) (Table 5). There were 10 and 23 patients with findings not related to trauma, which are incidentally detected, in group I and group II, respectively (Table 6).

DISCUSSION

Results of the present study have demonstrated the perspective in using imaging tests that has evolved among ED physicians over the years. This study comprised a particular patient population aged above 65 years, thus the results of this study cannot be generalized for younger trauma patients. We acknowledge that the increased use of imaging tests for older adults may be due to the possibility of increased awareness that relatively minor injuries can have significant clinical consequences for older adults. However, despite having similar RTS and

GCS values there was a significant difference in the number of patients who underwent X-ray and CT examinations between two different time periods. Although an increasing number of imaging tests were requested, there was no difference between the two groups in imaging findings that suggested major trauma or required a longer inpatient stay. In addition, there was a positive correlation between the Glasgow coma scores and the number of CT scans in group II which reflects the tendency to practice defensive medicine. Normally, an inverse correlation would be expected between the GCS values and the number of CT scans.

We acknowledge that improvements in CT scanners may also push physicians to request CT examinations particularly during rush hours in ED. CT became an essential tool to reduce the ED crowding because of its features having the capability to scan all viable organs (including coronary arteries) with a single CT examination[9, 10]. The imaging plays a crucial role in the management of trauma patients and its value is further important for geriatric trauma patients who are more prone to trauma related morbidity and mortality[3, 4]. In a prospective practice performed for the audit of orthopedists, defensive imaging was found to be both commonly used and costly. According to the results of this study, nearly 20% of all imaging orders by participating orthopedic surgeons in Pennsylvania could be attributed to defensive medicine practices[11]. A study conducted by Studdert, et al[8] found that 92% of physicians used imaging tests and diagnostic measures for reassurance, while 42% requested these tests in patients to avoid high risk procedures and potential complications. Lambert and colleagues[6] evaluated the trends in emergency cranial CTs in a general university hospital during the last 15 years. The researchers found that the annual number of emergency cranial CTs increased sharply 5.5 times from 124 to 679 since 2013. This trend showed a negative correlation with the number of hospital beds, the proportion of important findings on cranial CT, the proportion of patients indicated for cranial CT according to the NICE 2014 criteria, however, showed a positive correlation with the proportion of inebriated patients and their average GCS score. In return, they concluded that the increase in the emergency cranial CTs cannot be entirely justified by clinical needs of the patients. This is the result of absence of adherence to the guidelines in the legislation together with a medico-legally unpredictable environment[6]. In a similar study, Chen J et al[5] reported that 38% of CT scans ordered in a level I trauma center were for defensive purposes. Technological developments and physicians' fear of malpractice have reduced the threshold to refer a patient to imaging, which is a CT scan in case of trauma. Results of the present study confirmed this fact, as we noticed a significant difference in the numbers of CT scans performed in the two patient groups who were admitted to the emergency department at different time periods but had similar trauma scores. In contrast to Group I, we also found a positive correlation between the Glasgow coma scores and the number of CT scans in group II. Therefore, we concluded that the increasing need for radiological examinations over the years have arisen as a consequence of tendency to practice defensive medicine. There is an increase in the number of medical malpractice cases concluded in the General Assembly of Council of Forensic Medicine of Turkey over the years[12]. Defensive medicine is highly prevalent among high-risk specialist physicians and has potentially serious implications for patient care costs and accesses. Overuse of diagnostic tests, unnecessary referrals, and avoidance of high-risk patients are the most common forms of defensive medicine[8].

Imaging tests are indispensable tools particularly for ED physicians in the management of trauma patients. Nevertheless, there is no doubt that increased number of X-rays or CT scans expose patients to radiation which has been reported to be responsible for the increased cancer risk[13, 14]. Although the radiation dose from a single CT examination was not significantly high in our study, the total radiation dose may significantly increase cumulatively as a result of an advance in the number of examinations. Moreover, Ahmadinia et al[15] reported that the number of CT scans per trauma patient doubled over 6 years, which generates more radiation exposure and charges per patient, despite no change in mortality or injury severity. There is less concern regarding the risk of cancer related to the ionizing radiation in geriatric patients[4]. However, the cancer risk attributed to unnecessary imaging tests should not be neglected in any patient population.

As we experienced in the present study, incidental findings which are not related with trauma and emergency patient care can also be detected during emergency imaging. While some of these incidental findings are benign and do not require follow-up or treatment, others require follow-up serial imaging or

appropriate treatment[16]. Hence, non-traumatic pathologies should also be kept in mind while evaluating for trauma cases, and each region entering the field of view should be evaluated in detail.

One of the limitations of the present study was its retrospective nature. Another limitation was the age criteria defined as above, thus we could not generalize the results of this study for younger patient population. The causes and also degree of trauma in younger patients are quite different compared to geriatric patients. The gray zone in a trauma patient that make ED physician to reconsider the idea of ordering an imaging test, is relatively limited in younger trauma patients. Therefore, we conducted the study in geriatric trauma patients to reveal the essential effect of defensive medicine in ED.

In conclusion, the utilization of imaging has increased over the years, although demographic characteristics, trauma scores, trauma-related major findings and inpatient stay lengths are similar in patient groups. In addition to increased radiation dose that is caused by unnecessary radiological examinations, excess number of examinations result in heavy burden on health care systems and radiologists' workload. The data reported in this study indicates the influence of defensive medicine on ED physicians' care for patients. Clinical studies that is to be conducted in more than one center and with a larger sample size will be useful to strengthen our findings.

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