

CT and MRI examinations left behind in the radiology department

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PURPOSE

To retrospectively document the reported computerized tomography (CT) and magnetic resonance imaging (MRI) examinations that were left behind in our radiology department, to calculate their cost, and to determine possible sources of waste in order to draw attention to this subject.

MATERIALS AND METHODS

The reported and billed CT and MRI examinations for 2003 that were not taken from the radiology department were documented, and the percentage they represented of all CT and MRI performed that year were determined. The total cost of the examinations, including contrast media, was calculated.

RESULTS

In all, 200 CTs out of 4390 and 95 MRIs out of 7003 were left behind in the radiology department during 2003. Total cost of the examinations, including the contrast media, was 31,320 YTL.

CONCLUSION

The percentages of CT and MRI examinations left behind in the radiology department were evaluated in this preliminary report. Since we did not find any similar study in the literature, we could not comment on the limits of acceptability of the results; however, we think other radiology departments should determine the percentages CTs and MRIs that are left behind and take the necessary precautions to minimize waste and reduce expenses.

Key words: • computed tomography • magnetic resonance imaging • healthcare expenses

Expensive examinations, such as computed tomography (CT) and magnetic resonance imaging (MRI), which require advanced technology, have been used more extensively in recent years. Therefore, we thought it was important to document and evaluate CT and MRI examinations, which were paid for, but not taken from the radiology department, especially those obtained and reported in university and training hospitals. In this study, we aimed to draw attention to CT and MRI examinations that are left behind in radiology departments, a topic, which, until now, has not been adequately addressed.

Materials and methods

We counted and documented the CT and MRI studies performed in our radiology department during 2003 that were paid for but not taken from the radiology department until June 2004. CTs were categorized according to age group, gender, referral to the radiology department (emergency, out- or inpatient), departments referring the patient (departments of internal medicine or surgery), results of the exam (normal, significant or insignificant pathology), anatomic site of the examination (cranium, thorax, abdomen, or other sites like sinuses, extremities, etc.), and social security insurance status of the patients (has, does not have). Age groups were classified as pediatric (≤ 18 years), adult (19–64 years), and geriatric (≥ 65 years). Simple cysts that were determined incidentally, or did not require further studies or therapy, and findings that did not require therapy, like sequelae calcifications, or senile changes, were defined as clinically insignificant pathology. Findings that might affect the clinical progress, such as acute infections, infarcts, hemorrhages, effusions, or fractures, were considered clinically significant pathology.

MRIs were classified according to age group, gender, result of the exam, and examination site. As the number of MRIs was less than that of CTs, examination sites were categorized in 2 groups, neuroradiological studies and others (musculoskeletal and abdominal studies). The MRI study forms could not be obtained as they were sent for insurance processing without being copied. Thus, the referrals to the radiology department, departments referring the patients, and social security status of the patients could not be determined.

Statistical analyses were performed using chi-square and Z-ratio tests.

Total cost of the untaken studies was calculated by multiplying the per unit cost of each study by the number of studies, and then adding the mean cost of the contrast medium that was used.

Results

CT studies

Of the 4,390 CT studies performed in 2003, the films of 200 were not taken (4.56%). Of the 200 left-behind CTs, 37 were pediatric patients',

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126 were adults', and 37 were geriatrics'. CTs of male patients accounted for 60% of those left behind and 40% were for female patients. The emergency service ordered 61% of the untaken studies, whereas 31% and 8% were for out- and inpatients, respectively. Of all the untaken studies, 47% were requested by the departments of internal medicine, whereas 53% were ordered by the departments of surgery, and the difference between these 2 groups was not statistically significant. The distribution of referrals to the radiology department is presented in Table 1. Distribution according to the site of CT was as follows: cranial, 77%; abdominal, 9.5%; thorax, 6.5%; spinal, 6%; other, 1% (Table 2). Normal reports accounted for 60.5% of the CT results, whereas pathologic reports accounted for 39.5% (24% were clinically significant and 15.5% were insignificant) (Table 2).

Among the 200 CTs left behind, 26.5% were for patients that paid for the procedure out-of-pocket and 73.5% were paid for by social security insurance. In the present study, there was not a significant relationship between left-behind CTs, and age, gender, or referral clinics ($P < 0.05$).

According to Turkey's 2003 Budget Applications Instructions, the per unit cost of a CT examination was 90 YTL (New Turkish Lira); thus, total cost of the 200 left behind examinations was 18,000 YTL (1). Of the 200 left behind CTs, 25 were enhanced, with a mean cost of 100 YTL for contrast medium. As a result, the total cost was calculated as 20,500 YTL (18,000 YTL for the exams themselves + 2500 YTL for the contrast media).

MRI studies

In our department a total of 7,003 MRI examinations were performed in

2003. Among those, 95 were left behind (1.36%). Of those 95, 21 were pediatric patients', 49 were adults', and 25 were geriatrics'. In all, 47% were for male patients and 53% were for females.

The abnormal report rate was 74.8%, while the normal report rate was 25.2%. According to imaging site, the majority of the films were neuroradiological MRIs (72.6%), while 27.4% were musculoskeletal and abdominal MRI examinations. Table 3 shows the distribution of mean MRI examination results and imaging sites.

The rate of clinically significant neuroradiological examinations was 53.7%, while 18.8% were clinically insignificant pathologies and 27.5% were normal. Among musculoskeletal and abdominal MRIs, 19.2% had normal results, 50% had clinically significant abnormal results, and 30.8% had clinically insignificant abnormal results (Table 3).

The unit price per MRI in 2003 was 100 YTL; thus, the cost of 95 MRIs was 9500 YTL (1). Of the 95 MRIs, 11 were performed using contrast media, which cost about 120 YTL per study, making the total cost 10,820 YTL (9,500 YTL for the exam itself + 1,320 YTL for the contrast media).

Discussion

Turkey's national income is about 200 billion US dollars (USD) and 3%–4% of this is spent for health expenditures. Annual per person health cost was 55 USD in 1980 and rose to 135 USD in 2000. According to these data, it can be clearly seen that health expenses increased more than 2-fold in the last 20 years. Total health expenditure was 2.5 billion USD in 1980, versus about 9 billion USD in 2000 (2–7). The striking rise in these numbers is related mainly to an increase in life expectancy, an increase in population, and new technologies used for diagnosis and treatment. We decided to investigate CT and MRI examinations that were left behind in our radiology department, despite their reporting having been performed. To the best of our knowledge, this is the first study of its kind to be conducted in Turkey.

Results of the present study show that 4.56% of CT and 1.36% of MRI exams were left behind in the radiology department. One reason there are more CTs left behind than MRIs could be the consultations taking place in

Table 1. Distribution of left-behind CT films according to mean report results and the type of initial referral to the hospital

	Normal	Clinically significant	Clinically insignificant	Total
Emergency examinations	79 (39.5%)	26 (13%)	17 (8.5%)	122 (61%)
Outpatients and inpatients	42 (21%)	22 (11%)	14 (7%)	78 (39%)
Total	121 (60.5%)	48 (24%)	31 (15.5%)	200 (100%)

Table 2. Distribution of left-behind CT films according to mean report results and the site of examination

	Cranial	Thorax	Abdomen	Spinal	Others	Total
Normal	101 (50.5%)	9 (4.5%)	8 (4%)	3 (1.5%)	0	121 (60.5%)
Clinically significant	34 (17%)	3 (1.5%)	9 (4.5%)	1 (0.5%)	1 (0.5%)	48 (24%)
Clinically insignificant	19 (9.5%)	1 (0.5%)	2 (1%)	8 (4%)	1 (0.5%)	31 (15.5%)
Total	154 (77%)	13 (6.5%)	19 (9.5%)	12 (6%)	2 (1%)	200 (100%)

Table 3. Distribution of left-behind MRI films according to mean report results and the site of examination

	Neuroradiological	Musculoskeletal + abdomen	Total
Normal	19 (20%)	5 (5.2%)	24 (25.2%)
Clinically significant	37 (38.9%)	13 (13.6%)	50 (52.6%)
Clinically insignificant	13 (13.6%)	8 (8.4%)	21 (22.2%)
Total	69 (72.6%)	26 (27.4%)	95 (100%)

front of the monitor in emergency conditions. Although the untaken film rates seem to be small, the total cost of 31,320 YTL is a waste of resources that cannot be ignored. Today's vision of quality control includes providing service with zero defect and zero waste; thus, it is aimed that left behind films equal zero or close to zero (8, 9). As there is no similar study in the literature, these rates cannot be compared to other data.

In our study, CT and MRI examinations were considered in the context of many parameters. As there was no statistically significant relationship between untaken CT films, and age, gender, or referral clinic, or between untaken MRI films, and age or gender, these factors seem to have had no effect on films being left behind. Considering CT examinations according to the cause of referral to hospital, the majority of untaken films belonged to patients coming through the emergency service, and among them, cranial CTs were most common. This rate becomes more striking if we consider the limited number of emergency referred CTs compared to referrals for out- and inpatients. In emergency conditions, most patients' clinical problems are solved in front of the monitor with the instant consultation of the radiologist; therefore, reported studies prepared few days after the procedure are usually left behind, which may be one of the reasons for the high rate of untaken emergency films.

The rate of untaken CTs with significant abnormal reports was 24%, versus 52.6% for MRIs. The discrepancy in these rates may be due to the superior-

ity of MRI as a diagnostic modality. Left-behind films that showed clinically significant pathology may have been a consequence of patients referring to another hospital and undergoing similar examinations of the same anatomic region. Our observations show that this accounts for a large amount of wasted resources in Turkey. Considering these left-behind films, which contain clinically significant pathology, will help demonstrate the defective relationship between patients, clinics, and radiology departments.

In terms of examination site, cranial CTs and neuroradiological MRIs accounted for the majority of untaken films. These modalities are used to visualize neuropathology and clinicians often prefer consultation in front of the monitor rather than waiting for the reporting process. In our department, CT studies are reported 2 days after the exam and MRI studies are reported a minimum of 3 days after the exam.

In total, 73.5% of untaken films belonged to patients with Turkey's state social security insurance. This high rate, at first glance, made us think of the inappropriate use of government health resources. However, considering the referral rates in our hospital in 2003 (83% social insurance, 17% paying out-of-pocket), the untaken film rates were similar between these 2 groups.

The lack of similar studies in the literature led us to think that no such problem is experienced in developed countries. Management of health and insurance systems in those countries with inspection, archiving, and PACS (picture archiving and communication

system) are thought to be cost reducing factors.

In conclusion, the issue of CT and MRI examinations left behind in radiology units has not been previously studied in Turkey. As a result of developing technologies, expensive examinations like CT and MRI are used with increasing frequency and account for a major portion of health expenditures. In order to overcome the waste associated with these methods, untaken films must be documented, problems and possible solutions must be highlighted, and consequently, conscious management of health resources aimed at the target of zero defects can be established.

References

1. 2003 yılı Bütçe Uygulamaları Talimatı.
2. Oyan O. Türkiye ekonomisi, nereden Nereye? İmaj Yayıncılık, 1998.
3. Sağlık Hizmetleri Temel Kanunu, 1987.
4. Sağlık Bakanlığı, Türkiye Sağlık Sektörünün Finansmanı, Ankara; 1993.
5. Sağlık Bakanlığı, Türkiye Sağlık Harcamaları ve Finansmanı 1992-1996, Ankara; 1998.
6. Sağlık Bakanlığı, Türkiye Sağlık Harcamaları ve Finansmanı 1998, Ankara; 2001.
7. Soyer A, Yazgan A, Kılıç B. Sağlıkta dönüşüm programı 2003 Türkiye'sinde halka ve hekimlere/sağlık personeline neler getiriyor? Ekim 2003.
8. Reichheld FF, Sasser WE Jr. Zero defections: quality comes to services. *Harv Bus Rev* 1990; 68:105-111.
9. Brand A, Brand H. Approaches to quality management in public health: current and future prospects. *Gesundheitswesen* 2001; 63:226-230.