

Efficiency of Outsourcing Reporting in Thorax Computed Tomography Evaluation: Retrospective Analysis of 350 Thoracic Surgery Cases

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Abstract

OBJECTIVE: External reporting is frequently used due to the significant increase in computed tomography examinations in recent years and the insufficient number of personnel in internal reporting. We aimed to evaluate the adequacy of outsourcing reporting.

MATERIAL AND METHODS: Patients who were seen or hospitalized as a consultation by thoracic surgeons with thoracic computed tomography between January 2021 and January 2022 were included in the study retrospectively. Computed tomography results reported by radiologists working in our hospital were grouped as "internal reports," and the results reported externally by a company were grouped as "outsourcing reports." The total number of computed tomography examinations taken during the same period and the number of examinations reported by a daily average radiologist were also determined. False-negative findings in internal and outsourcing reports were evaluated and statistically compared between groups.

RESULTS: A total of 84 702 computed tomography scans were taken in 2021. In external reporting, 1 physician reported an average of 202.83 computed tomography scans per day (74 033 per year). A total of 350 thorax computed tomography reports were evaluated. A total of 304 (86.9%) thorax computed tomography examinations were reported with external reporting and 46 (13.1%) with internal reporting. False-negative findings other than those reported were found in 81 reports (23.1%). A significantly higher deficiency was observed in external reporting (77/304) compared to internal reporting (4/46). ($P = .013$).

CONCLUSION: The effectiveness of external reporting was found to be lower than internal reporting due to a possible lack of communication and audit problems. In order to minimize the errors and related liability arising from external reporting, primarily a legal standardization is required with realistic reporting numbers of external reporting.

KEYWORDS: Computed tomography, overlooked findings, outsourcing, radiology, thoracic surgery

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INTRODUCTION

With the transformation of the health system in Turkey in the early 2000s, the referral system was abolished and all patients can apply to any hospital they want. In addition, the defensive approach is adopted by physicians with malpractice regulations that are disproportionate to income. Due to these, a significant increase is observed in the number of hospital admissions and computed tomography (CT) examinations.¹

Additionally, with technological developments, outsourcing/external reporting has been actively used in our country for the last 10 years.¹ Adding to this, the pandemic process and the evaluation of lung involvement in coronavirus disease 2019 with CT have greatly increased the burden on radiologists.² With the inadequacy in the number of radiologists employed, outsourcing reporting has become more widely used to solve this problem.¹

In the radiological reporting of standard CT, an average of 3%-5% and up to 15% in 1 study, the error margin is stated in the literature.³⁻⁴ In addition, there are studies representing that the margin of error in external reporting is higher due to fundamental reasons such as disconnection between the clinician and the radiologist and the greater number of daily CT evaluations.⁵

We aimed to evaluate the efficiency and margin of error of outsourcing reporting in thorax CT scans taken in our hospital, together with possible reasons.

MATERIAL AND METHODS

Ethics committee approval from the Niğde Ömer Halisdemir University Ethics Committee with the decision number E-958 60085-050.02.04-138333 was obtained before the study and the study was carried out in accordance with the principles

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of the Helsinki Declaration. Since it was a retrospective study and anonymous patient data were shared, patient consent was not required.

The total number of CT scans taken between January 2021 and January 2022 in our hospital was determined. Internal and external reporting and the number of evaluations per day per radiologist were calculated. When calculating the number of CT scans evaluated daily, the total number of CT scans was divided by 52 weeks in the year, since internal reporting was done 1 day per week by each radiologist. Since external reporting is used every day and especially in the emergency room, the divisor of 365 was used.

Patients who were evaluated by the thoracic surgeon after consultation in the emergency department, hospitalized after being evaluated in the outpatient clinic, or referred to the upper center for further examination were included in the study between January 2021 and January 2022 retrospectively. Patients who did not have a thorax CT and had no pathological findings found in the CT were excluded from the study.

Computed tomography results reported by radiologists working in our hospital were grouped as "internal reports," and those reported externally by a company were grouped as "outsourcing reports." Computed tomography findings were evaluated in 3 groups as "bone," "mediastinum," and "parenchyma."

Patients' age, gender, reason for admission, internal/external report status, indication for evaluation, false-negative findings outside the report, and life-threatening condition due to missed pathology were recorded retrospectively on the database. False-negative findings in internal and outsourcing reports were evaluated and statistically compared between groups. Computed tomography scans of patients with false-negative findings were re-evaluated by an employed radiologist, and false-negative findings were reconfirmed.

When determining a life-threatening situation, the effects of fractures and dislocations of the bones in the body were classified according to their degree. Fractures are classified as mild, moderate, and severe (Table 1). In case of more than 1 fracture in the body, in order to find the effect on vital functions, the squares of the degrees of each fracture are added and the square root of the total number is taken. If the number is greater than 0.5, it is graded above, if it is small, it is graded

MAIN POINTS

- The study reveals that there is a significant amount of overlooked data in outsourced reporting in branch-specific thoracic surgery thoracic computed tomography examinations.
- Overlooked data did not yield significant results in terms of life-threatening condition and/or hospitalization.
- The majority of tomography examinations are evaluated in external reporting.
- There is a need for standardization in evaluation and quality control in outsourcing reporting.

Table 1. Rib Fracture Severity

Classification	Number of Fractured Ribs
Mild	1
Moderate	2-3
Severe	4-5-6

down. Two or three points for all kinds of rib fractures resulting from thoracic trauma (2 points for each 3 rib fractures, 1 point for more than 3 rib fractures). Three points are given for nondisplaced sternum fracture and 4 points for a displaced sternum fracture. In addition, pneumothorax, hemothorax, lung contusion, and major organ damage were grouped as life-threatening cases.⁶

Statistical Analysis

All analyses of the research were evaluated with the Statistical Package for the Social Sciences version 24.0 package program (IBM Corp.; Armonk, NY, USA). Descriptive statistics were given as number of units (n), percent (%), and mean \pm standard deviation (mean \pm SD) for age. Pearson chi-square analysis was used to compare the distribution of categorical variables between groups. A *P* value below .05 was considered statistically significant.

RESULTS

The total number of CT scans taken in our hospital in 2021 was 84 633. Of these CT scans, 84 702 were reported in outsource reporting and 8775 in internal reporting. Two radiologists served in external reporting and 6 radiologists in internal reporting. The number of CT scans reported by each radiologist and their daily average are shown in Table 2.

A total of 350 patients included in the study. The mean age of 350 patients who participated in the study was 48.36 ± 20.64 (min: 9, max: 94), and the median age was 50.50. The demographic and clinical characteristics of the patients are shown in Table 3.

Table 2. Annual and Average Daily Number of CTs Reported per Radiologist and Internal-External Reporting Rate

Radiologist	Number of Annual Reports	Average Number of Reports per Day	Ratio (%)
OR1	74 033	202.83	89.6%
OSR2	1825	5	
IR1	2142	41.19	10.4%
IR2	1527	29.36	
IR3	808	15.53	
IR4	1346	25.88	
IR5	1444	27.76	
IR6	1508	29	

IR, internal reporter; OSR, outsourcing reporter.

Table 3. Demographic and Clinical Characteristics of Patients

Characteristics	n = 350	Ratio (%)
Gender		
Female	73	20.9
Male	277	79.1
Reason for admission		
No complaint	9	2.6
Blunt trauma	195	55.4
Dyspnea	65	18.6
Chest pain	23	6.6
Penetrating trauma	21	6
Cough	17	4.9
Hemoptysis	6	1.7
Fever	5	1.4
Other	10	2.9

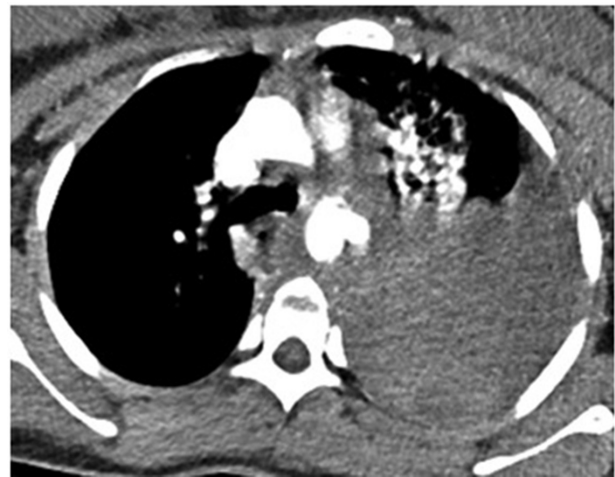


Figure 1. Extravasation from the aorta overlooked in the report.

When our cases are evaluated in terms of thorax CT, 304 (86.9%) cases were reported with external reporting and 46 (13.1%) with internal reporting. In the evaluations between the reporting of the patients and the opinion of the surgeon, false-negative findings were found in 81 patients (23.1%). Internal and external reporting data results, along with subgroups of bone, parenchyma, and mediastinum, are shown in Table 4. When the rate of detection of false-negative findings was evaluated, a significantly higher deficiency was observed in external reporting (77/304) compared to internal reporting (4/46) ($P = .013$). Some overlooked CT findings at the mediastinum, bone, and parenchyma levels are shown in Figures 1-4.

Hospitalization indications of 81 patients with false-negative findings were evaluated. While 32 patients (39.5%) had an indication for hospitalization, it was observed that no hospitalization was required in 49 (60.5%) patients, and no significant correlation was found between the internal and external reporting groups ($P = .543$) (Table 5).

When the effect on the vital functions of the patients with false-negative findings is evaluated, 8 (9.9%) life-threatening and 73 (90.1%) non-life-threatening findings were omitted; non-life-threatening cases were also grouped as 13 (16%)



Figure 2. Sternal fracture overlooked in the report.

Table 4. Evaluation of Insource–Outsource Reporting Effectiveness Between General and Subgroups

False-negative finding	Total n = 350	Reporting				P
		Outsource		Insource		
		n = 304	%	n = 46	%	
Absent	269	227	74.7	42	91.3	.013*
Present	81	77	25.3	4	8.7	
Mediastinum	5	4	5.2	1	25	.322
Parenchyma	10	9	11.7	1	25	
Bone	66	64	83.1	2	50	



Figure 3. Right hilar mass obliterating the bronchus overlooked in the report.

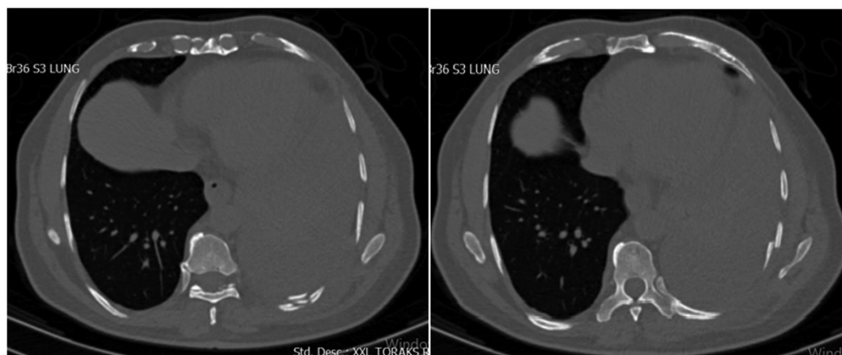


Figure 4. Rib fractures overlooked in the report.

Table 5. Evaluation of Patients with False-Negative Findings in Terms of Hospitalization Indications

Reporting	False-Negative Finding	Hospitalization Indication		P
		Present	Absent	
Outsource	77 (95.1%)	31 (40.3%)	46 (59.7%)	.543
Insource	4 (4.9%)	1 (25%)	3 (75%)	

mild, 42 cases (51.9%) moderate, and 18 cases (22.2%) severe in total cases.

DISCUSSION

In the outsourcing reporting, it is seen that 202.83 CT scans are reported daily by only a radiologist. While the margin of error detected in outsourcing reporting was found to be significantly higher than in internal reporting, no significant results were obtained when bone, parenchyma, and mediastinum groups were evaluated within themselves.

Outsourced reporting has become an instrument that is actively used all over the world, especially due to the need for rapid reporting and evaluation of tomography taken in emergency services, as well as the significant increase in the number of scans.⁷ As a matter of fact, the reporting of 89.6% of thorax CTs taken in our hospital with outsourcing reveals a similar picture.

It is stated that the number of images read in the literature is higher in outsourced reporting than in internal reporting.⁸ At the same time, the increase in the workload, combined with the lack of communication, can cause a serious increase in the margin of error.⁹ Due to its low cost, especially in the USA,

the use of outsourcing in all service offerings has increased considerably in the last period. In addition, outsourcing has become very common in the health system, especially in branches such as radiology, where remote imaging is evaluated. Although it is still used for pre-evaluation before health tourism for other branches, radiology has become the main field of outsourcing.¹⁰ In this sense, it can be said that telerradiology has shaped the radiology approach of the future after the widespread use and access of the internet and covering the whole of life.¹¹

When evaluating the share of diagnostic errors in outsourcing, it is stated that the margin of error in home reporting is less than 5% in the literature.^{12,13} However, in a study on 2040 CT and magnetic resonance (MR) images, outsourced CT and MR reports were evaluated by 2 different radiologists and found a 21.4% disagreement (with potential clinical consequences for the patient in 2.9% of patients).⁸ Apart from life-threatening factors such as pneumothorax and hemothorax, hospitalization and/or intensive care unit admission is indicated in patients over the age of 65 who have more than 2 rib fractures and develop respiratory distress.⁶ In our study, 25.3% of outsourced reporting cases had discrepancies and missing findings, while 10% included pathologies that required hospitalization.

In addition, reporting through a physician who does not work in the hospital brings along the communication problem with the clinician. At the same time, the problems experienced in communicating the history and physical examination findings to the reporting unit constitute the limitations of external reporting when evaluated in light of the literature.¹ In addition, the low number of cases, especially in internal reporting, makes it difficult to obtain healthy results in further evaluations in subgroups. Of course, larger and multicenter studies

evaluating the results of whole-body CT may also enable to evaluate the efficacy of subgroup and other system CTs.

As determined by the Hospital Standards Commission of the American Society of Radiology and defined as closest to the ideal, a radiologist stated that it is appropriate to evaluate 25 patients and 30-35 examinations per day, since each patient can include more than 1 examination. Similarly, the Swedish radiologist stated that this burden is not too high, at the American College of Radiology Teachers' Conference. He stated that a total of 500 procedures per day are performed in their clinics, from simple procedures such as chest and bone to the most complex neurological-cardiovascular procedures. There were 13 radiologists who performed these procedures, 38 reports were made per person per day, and with this data, an annual average radiologist made an average of 8000 evaluations.¹⁴

Another study showed that lung cancer detection was impaired with reduced imaging time, and similarly, when the radiologist reported more than 20 studies per day, error rates in abdominal CT reporting increased.¹⁵

It may be safe to outsource a teleradiology program with an active quality assurance program. An active quality assurance program should be an integral part of any teleradiology program. Continuous feedback improves the performance of radiologists.¹⁶ This situation, which is seen as compatible with other literature data, can only be increased by providing quality assurance.⁸ In order to ensure this quality, it has been stated that standardization should be established with the items listed below¹⁷:

- Clinical information
- Communication with the clinician in emergency pathologies
- Standard reporting method outline
- Radiologist contact information should be included in the report
- Review by local radiologists
- Mutual audit (internal-outsourced)
- Same enrollment provisions, including specialist registration, relicensing, recertification, revalidation, reaccreditation, assessment, clinical governance, and inconsistency
- Language proficiency in the report
- Legal liability scope
- A report should be created at the end of each term regarding the reporting physicians.

However, when the idealized numbers in the literature and the number of evaluations of a single radiologist in external reporting in our study are compared, even if the number of external reporting is expected to be higher, the enormous difference explains the results of the study itself.

The value of the study is that it is one of the first studies to evaluate the effectiveness of external reporting on a branch basis. In addition, we think that total CT numbers are evaluated on a hospital basis and provide valuable data to explain the reason for the disruption in daily reporting numbers.

The limitation of the study was the inclusion of cases with findings already in the study did not make it possible to evaluate false-positive patients.

In conclusion, the effectiveness of outsourced reporting was found to be lower than internal reporting due to a possible lack of communication and audit problems. By providing standardization in outsourced reporting, legally limiting the number of reports evaluated to a certain number per radiologist will bring about an increase in quality. The multidisciplinary and multicenter conduct of this study will provide a broader illumination on the subject.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Niğde Ömer Halisdemir University (Approval No: E-95860085-050.02.04-138333).

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