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Unnecessary test requests on common tests in blood gas and biochemistry test panel

Kan gazı ve biyokimya test panelindeki ortak testlerde gereksiz test istemleri

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ABSTRACT

Aim: This study aims to evaluate the frequency of unnecessary test requests and the economic burden caused by sodium (Na), potassium (K), and calcium (Ca) tests, which are common in blood gas panels and biochemistry tests.

Materials and Methods: Patients who underwent simultaneous blood gas and biochemistry tests at our hospital between January 2021 and December 2023 were retrospectively reviewed. Using data from the Hospital Information Management System, unnecessary requests were identified and quantified. The cost of the tests was calculated by multiplying the number of unnecessary tests by the Health Implementation Communiqué (SUT) score and the laboratory tender unit price.

Results: A total of 218,257 unnecessary test requests were identified over the three-year period. Compared to 2021, the number of unnecessary tests decreased by 12.9% in 2022 and 15.3% in 2023. The total financial burden of unnecessary requests was calculated as 1.427.749,99 TL.

Conclusions: Our study shows that unnecessary laboratory test requests represent a significant economic burden and that targeted interventions are needed to reduce costs. Measures such as defining diagnostic algorithms and minimum test request times in hospital information management systems, strict follow-up of test request processes and increasing physician awareness may be effective in reducing health expenditures.

Keywords: Biochemistry, blood gas analysis, health costs

ÖZ

Amaç: *Bu çalışmada, kan gazı panelleri ve biyokimya testlerinde yaygın olarak kullanılan sodyum (Na), potasyum (K) ve kalsiyum (Ca) testlerinin gereksiz test istemlerinin sıklığı ve neden olduğu ekonomik yükün değerlendirilmesi amaçlanmıştır.*

Gereç ve Yöntem: *Ocak 2021 - Aralık 2023 döneminde hastanemizde eş zamanlı kan gazı ve biyokimya testleri istenen hastalar retrospektif olarak incelendi. Hastane Bilgi Yönetim Sistemi verileri kullanılarak gereksiz istemler belirlendi ve sayısallaştırıldı. Testlerin maliyeti, gereksiz test sayısının Sağlık Uygulama Tebliği (SUT) puanı ve laboratuvar ihale birim fiyatı ile çarpılmasıyla hesaplandı.*

Bulgular: *Üç yıllık dönemde toplam 218.257 adet gereksiz test istemi tespit edildi. 2021 yılına kıyasla, gereksiz test sayısı 2022 yılında %12,9 ve 2023 yılında %15,3 oranında azaldı. Gereksiz istemlerin toplam mali yükü 1.427.749,99 TL olarak hesaplandı.*

Sonuç: *Çalışmamız, gereksiz laboratuvar test istemlerinin kayda değer bir ekonomik yük oluşturduğunu ve maliyetleri azaltmak için hedefli müdahalelere ihtiyaç bulunduğunu göstermektedir.*

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Hastane bilgi yönetim sistemlerinde tanı algoritmalarının ve minimum test istem sürelerinin tanımlanması, test istem süreçlerinin sıkı bir şekilde takip edilmesi ve hekim farkındalığının artırılması gibi önlemler sağlık harcamalarının azaltılmasında etkili olabilir.

Anahtar Sözcükler: *Biyokimya, kan gazı analizi, sağlık maliyetleri*

INTRODUCTION

Blood gas analysis is an important diagnostic tool that provides information about oxygenation, ventilation, acid-base balance, and electrolyte status. The advantages of blood gas analyzers in the assessment of electrolyte status are that they do not require centrifugation, and the analysis time is shorter. Electrolyte measurement in biochemical autoanalyzers is time-consuming due to sample clotting, centrifugation, and longer analysis time. Although the results obtained with autoanalyzers are believed to be more accurate and reliable, the relatively long processing time limits their value in the management of critically ill patients (1). In routine practice, blood gas and biochemistry are requested from patients simultaneously, and the same parameters are analyzed in both blood gas and biochemistry, leading to unnecessary test requests.

It has been reported that the rate of unnecessary test requests is between 20 and 30%, and the rate varies according to different test types and healthcare providers (2). Unnecessary test requests are considered a problem that increases healthcare expenditures as well as causing unnecessary workload all over the world and solution methods are discussed. Controls on unnecessary and excessive use of laboratory tests are becoming increasingly important in the management of rapidly increasing health care costs (3).

The burden of health expenditures in the national budget has increased significantly in worldwide years, and a significant portion of the health budget is spent on laboratory tests. Diagnostic tests are improving day by day worldwide, and the number of laboratory test requests is increasing every year accordingly. However, unfortunately, unnecessary test requests also cause a significant health expenditure (4). The effects of education, supervision and feedback, system-based interventions, and incentive and penalty strategies to reduce the use of laboratory tests have been investigated; however, it has been stated that the success of these interventions may vary depending on the context, method of implementation, and targeted behaviors. It was also emphasized that these interventions should be implemented in a unified and sustainable manner in order to achieve lasting effects on test use (5).

In our laboratory, the parameters of sodium (Na), potassium (K), and calcium (Ca) included in the blood gas panel are also included in the biochemistry test list. Blood gas and biochemistry tests can be requested simultaneously in emergency and inpatient services. Since blood gas is studied as a panel, it is more appropriate for biochemistry to limit these jointly studied tests in cases of simultaneous requests. The aim of our study is to retrospectively examine patients whose blood gas panel and biochemistry were requested patients simultaneously, and to investigate unnecessary test requests and additional costs caused by biochemistry tests that are common to the tests in the blood gas panel.

MATERIALS AND METHODS

Approval was obtained from the ethics committee of our institution within the Declaration of Helsinki, with the decision dated September 18, 2024, and numbered 1772. The results of Na, K, and Ca tests that were jointly studied and requested simultaneously in blood gas and biochemistry between January 2021 and December 2023 were obtained from the Hospital Information Management System.

Na, K and Ca tests were analyzed in biochemistry with the Roche Cobas 8000 autoanalyzer (Roche Diagnostics®, Mannheim, Germany) and in blood gas with the ABL-800 device (Radiometer America Inc., CA, USA).

In blood gas analysis, calcium was measured as ionized calcium, whereas in the biochemistry analyzer calcium was measured as total calcium. Despite representing different fractions, both tests are frequently ordered simultaneously in routine practice, leading to potentially unnecessary test requests and additional costs.

Since the blood gas was studied as a panel, unnecessary test request cost calculation was made based on the tests in biochemistry. Unnecessary test costs were calculated by multiplying the number of unnecessary tests by

the Health Practice Circular (SUT) score (current 2013 SUT, considering the amendment circular dated 18.05.2024) (6) and the laboratory tender unit price. The Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) package program was used for statistical analysis.

RESULTS

Unnecessary test requests and cost analyzes for sodium, potassium, and calcium tests between 2021 and 2023 were evaluated. The total number of unnecessary tests for Na, K, and Ca tests in 3 years was found to be 72,920, 73,031, and 72,306, respectively (Table-1). It was observed that the total number of unnecessary tests decreased by an average of 12.9% in 2022 compared to 2021, and by an average of 15.3% in 2023 (Figure-1). The share of Na, K, and Ca tests in total unnecessary tests was found to be 33.41%, 33.46%, and 33.13%, respectively. A total of 218,257 tests were requested unnecessarily in 2021-2023. When evaluated in terms of the economic burden caused by unnecessary test requests, it was determined that the cost arising from sodium tests was 477,013.47 TL, the cost of potassium tests was 477,739.59 TL, and the cost of calcium tests was 472,996.93 TL, resulting in a total financial burden of 1,427,749.99 Turkish lira (TL) (Table-2).

Table-1. Number of unnecessary test requests for sodium, potassium, and calcium parameters.

Parameter	SUT transaction score	Tender unit price (TL)	Number of unnecessary tests in 2021 (N)	Number of unnecessary tests in 2022 (N)	Number of unnecessary tests in 2023 (N)	Total number of unnecessary tests (N)
Sodium	11.05	0.592	26874	23347	22699	72.920
Potassium	11.05	0.592	26939	23383	22709	73.031
Calcium	11.05	0.592	26485	23215	22606	72.306

*SUT: Healthcare Implementation Communique

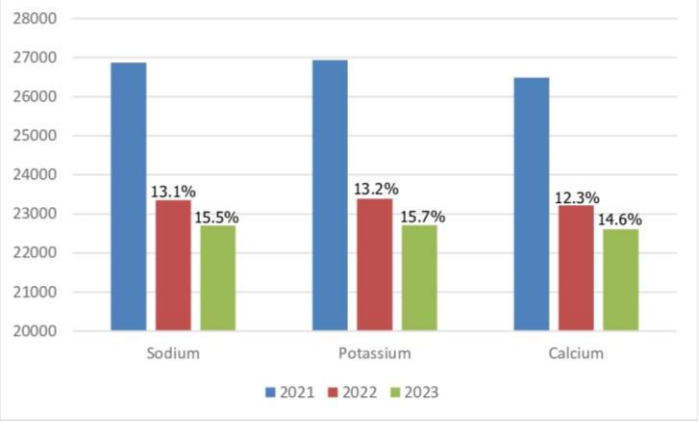

Figure-1. Number of unnecessary sodium, potassium, and calcium test requests in 2021-2023. Blue, red, and green bars represent the numbers of unnecessary tests in 2021, 2022, and 2023, respectively. The percentages above the bars indicate the percentage decrease in unnecessary test numbers in 2022 and 2023 compared with 2021.

Table-2. Unnecessary testing costs of sodium, potassium, and calcium parameters.

Parameter	Number of unnecessary tests (N)	Share of the test in the total number of unnecessary tests (%)	Unnecessary test cost (TL)
Sodium	72.920	33.41	477.013,47
Potassium	73.031	33.46	477.739,59
Calcium	72.306	33.13	472.996,93
Total	**218.257**	**100.00**	**1.427.749,99**

DISCUSSION

An important step towards the effective use of laboratory tests, which is an important item of healthcare expenditure in Turkey, was the rational test order procedure published within the scope of the Rational Laboratory Use Project, which was put into effect by the Ministry of Health in 2018 (7). This procedure aims for healthcare organizations to minimize unnecessary laboratory tests and use resources more efficiently by taking the necessary measures for rational test use.

In our study, it was observed that a total of 218,257 unnecessary tests were requested in a three-year period, and the financial equivalent was 1,427,749.99 TL. In 2023, the number of unnecessary tests decreased by 15.3% compared to 2021. This decrease may be a result of awareness-raising practices, arrangements made in laboratory test request processes, or clinicians' tendency to avoid unnecessary test requests. However, the fact that a total of 218,257 unnecessary tests were ordered during the three-year period suggests that further improvements are needed.

According to data from the Turkish Statistical Institute, total healthcare expenditures increased by 41.6% in 2021, 71.5% in 2022 and 105.0% in 2023 compared to the previous year, reaching 1 trillion 244 billion TL (8). A study published in 2021 suggested that laboratory expenses correspond to approximately 5% of total hospital expenses and that there has been an increase in the number of laboratory tests over the years (9). The reason for this increase may be unnecessary test requests due to physicians ordering bulk tests through panel tests that they create for convenience due to the very short examination time, ordering too many tests to avoid malpractice, not using disease-specific diagnostic algorithms in test requests, not having sufficient information about laboratory test costs, not having sufficient information about rational laboratory use, and rational test ordering procedure.

Published in 2017, Karakoyun et al. reported that 9,759 free prostate-specific antigen (fPSA) tests were requested unnecessarily in a five-year period, and the financial cost was 19,539 Turkish liras. It was suggested that this was due to clinicians ordering both total prostate-specific antigen (tPSA) and fPSA tests at the same time instead of following the algorithms (10).

In a study by Tekçe et al. investigating the compliance of thyroid function test requests with the algorithm, it was found that the number of unnecessary requests for free triiodothyronine and free tetraiodothyronine tests in one year was 25,505 and the approximate cost of these tests was 114,772 Turkish liras. It has been reported that the algorithm that should be followed in the diagnosis and follow-up of thyroid gland dysfunctions is still not adopted to a significant extent and unnecessary requests are reflected as additional costs to the healthcare system (11).

In a study conducted by Savaş et al. investigating unnecessary test requests in the diagnosis of iron deficiency anemia, it was determined that 301 of 566 patients who had hemoglobin and iron parameters (Fe, TIBC, ferritin) requested simultaneously in a one-month period had all parameters within the normal range and that 53.1% of unnecessary requests were made. It was reported that the additional cost paid for 301 cases was 2,383.92 TL, causing an annual financial burden of 28,607.04 TL (12).

In the study by Aydoğdu et al. published in 2025, the minimum time interval criterion between two requests for the same test in the rational test request procedure of the Ministry of Health was taken as the basis for determining the unnecessary requested tests. The cost of unnecessary requests for 15 tests in an 18-month period was found to be 584,186.3 TL. The unnecessary test rate is 9.1%, and it has been suggested that the ratio of unnecessary test costs to total test costs is 11.7% (13).

In the study by Aşçı et al., it was stated that the unnecessary test request rate was 6.2% according to the compliance of 25 tests with the minimum test repetition interval in 4 years. It was suggested that the 4-year cost of unnecessary test requests was 5,479,093.37 TL and the use of laboratory tests increased by 123.6% in 4 years (14).

Calcium measurement represents an important limitation of this study. Ionized calcium is measured in blood gas analyzers, while total calcium is measured in biochemistry analyzers, and their clinical indications may differ. However, in routine clinical practice, both tests are frequently requested simultaneously without considering their specific indications. Therefore, regardless of the calcium fraction measured, the simultaneous

ordering of both tests contributes to unnecessary test utilization and increased healthcare costs.

CONCLUSION

The results of our study reveal the extent of unnecessary test requests for Na, K, and Ca tests in our hospital and the financial burden on health expenditures. The appropriate and efficient use of laboratory tests is an important step in controlling increasing health expenditures, and various strategies need to be developed and implemented to reduce unnecessary test requests. A few simple measures such as sharing laboratory costs with clinicians to increase awareness among physicians, defining diagnostic algorithms and minimum test request periods in hospital information management systems and more stringent monitoring of test request processes will lead to a significant reduction in laboratory expenses and health expenditures.

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