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Short Communication

Laboratory intervention to improve the request of urinary albumin in primary care patients with arterial hypertension and financial implications

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ABSTRACT

Introduction: The request of Urinary albumin in primary care in Spain is insufficient to monitor patients with diabetes and hypertension (HTN). Our aim was to evaluate a strategy designed in consensus with general practitioners (GPs) to improve the request of urinary albumin in primary care patients with HTN according to guidelines, and to study its financial implications.

Materials and methods: In a meeting with GPs, we decided that the Laboratory Information System (LIS) would automatically register the albumin-to-creatinine ratio (ACR) test in patients with HTN when the former had not been requested in the previous year. We counted the number of ACRs requested by the GPs, those that were automatically added through the intervention, and if they were measured through the strip assay or additionally through quantification. We calculated the economic cost of the additional registered ACR based on reagent cost.

Results: In the 6 months study period, the laboratory received 48,075 requests for primary care patients. For 3816 (7.9%), HTN was the indication that prompted the request. 386 ACR were automatically registered through the intervention. Use of strip analysis cost of 275.8 € but resulted in savings of 1450.3€ in albumin reagent.

Conclusions: By making use of the laboratory technology, the strategy achieved a better adherence to the guidelines at no additional cost.

1. Introduction

Urinary albumin is under-requested in primary care in Spain, and is insufficient to correctly monitor patients with diabetes and hypertension (HTN) [1]. Advances in technology have made albumin an additional exam on the urinalysis strip, turning this marker into a very affordable laboratory test. In fact, strip analysis has a strong positive correlation with the inmunonephelometrical assay [2], and this has positioned the albumin strip assay as a screening test to identify albuminuria [3].

HTN represents an important health problem worldwide [4]. The laboratory plays a crucial role in the monitoring of HTN, as testing is key in the disease management and detection of additional risk factors or organ damage [5], and to detect and prevent comorbidities. The measurement of urinary albumin is recommended in the diagnosis and follow-up of patients with HTN as they are at risk of nephropathy. Guidelines recommend the test once a year for monitoring [5]. There is however, an overall under-request of the test in patients with HTN, as only half had urinary albumin measurement and 1 out of 4 had the spot ACR screening test. That suggests there is a need to promote the evaluation of ACR [6].

Computerized patient order entry (CPOE) has greatly improved the number of laboratory requests with patient clinical information, and HTN is the second most prevalent diagnosis that prompted a laboratory test in primary care [7].

Our main objective was to evaluate a strategy to improve the request of urinary albumin in primary care patients with HTN through the automatic registration of the test by the LIS according to guidelines. We also studied the financial implications of the strategy, taking into account the use of the ACR strip as a screening test prior to quantification.

Abbreviations: HTN, hypertension; GPs, general practitioners; ACR, albumin-to-creatinine ratio; CPOE, computerized patient order entry; LIS, laboratory information system; PCCs, primary care centers; HD, health departments; IQR, interquartile range

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We hypothesized that there was an opportunity to improve HTN monitoring through the design and establishment of interventions for a better urinary albumin request at a low cost.

2. Materials and methods

2.1. Study design

A prospective intervention was undertaken from February 1st 2018 to July 31st 2018.

2.2. Setting

The laboratory is located at the public University Hospital of San Juan (Alicante, Spain), a 370-bed suburban community hospital that serves a population of 234,551 inhabitants, including nine different primary care centers (PCCs). Primary care samples are transported by couriers to the laboratory, and requests are made through CPOE that offers the GPs a field regarding the reason for the laboratory request, through International Classification of Diseases, Ninth Revision, Clinical Modification (CIE-9-MC) codes [8]. We included primary care patients of the Health Department (HD) covered by the clinical laboratory.

2.3. Laboratory methods

The ACR strip test is based on protein error of pH indicator (tetrabromophenol blue) and measured in UC-3500 (Sysmex, Kobe, Japan) that is located in the clinical laboratory at the main hospital. The quantitative urinary albumin was measured through an immunoturbidimetric assay and creatinine through a kinetic colorimetric assay based on the Jaffé method. (Cobas 8000, Roche, Mannheim, Germany). When albumin quantification is requested, we first measure via strip test. If values for strip albumin and creatinine are 10 mg/L and above 50 mg/dL respectively, the quantified urine albumin is not measured and is automatically reported through a comment “Based on semiquantitative strip measurement, ACR is below 30 mg/g with a probability of 99%” [3].

2.4. Prospective intervention study

In a first stage, a meeting was held between the laboratory professionals and the GP in charge of one of the PCCs to improve guidelines adherence regarding ACR measurement in HTN. The team decided that strip ACR would be automatically added by the LIS to patients with HTN (CIE-9-MC codes) [8] when the test had not been requested in the previous year, and there was urine availability. In case of positive strip, sample underwent a quantitative ACR test.

Thereafter, a report was sent to the GPs coordinators of the different PCCs informing about the proposed strategy, and a two months reflection period was established to communicate the intervention to every GP. In a last meeting, the strategy was approved by the Executive Director of Primary Care, GPs and the Chair of Pathology at the main Hospital. The study was also approved by the hospital research committee.

2.5. Data collection and processing

We counted the total number of primary care requests, the number of those for patients with HTN, and the number of ACR tests that were requested and additionally registered. We evaluated the number of ACR with values below 30 mg/g (normal rate of albumin excretion), between 30 and 300 mg/g (moderately increased albuminuria) and above 300 mg/g (severely increased albuminuria) [9], when ACR was requested by the GP and when automatically registered. In both groups, we also calculated how many were measured only by albumin strip assay as a screening test or additionally through quantification. We calculated the total economic cost, taking into account the total number of additional ACR tests and the cost of the reagent (0.04€ per spot ACR test and 1.31€ per quantified albumin plus creatinine).

Table 1
Characteristics of requests with HTN diagnosis.

		Requests due to HTN		Requests with automatic ACR registration	
N	%	3816	7.9% of total PC requests	386	12.7% of total ACR measured
Age (median, P25-P75)		68 (57–77)		68 (57–76)	
Sex (N, %)		1790	46.9%	168	43.5%
- Male					
- Female		2026	53.1%	218	56.5%
Number of ACR requests		2657		–	
Number through strip analysis N	%	1142	43.0%	181	46.9%
Number ACR quantified N	%	1515	57.0%	205	53.1%
ACR values	%	2333	87.8%	347	89.9%
- < 30 mg/g Creatinine N					
- 30–300 mg/g Creatinine N	%	279	10.5%	36	9.3%
- > 300 mg/g Creatinine N	%	45	1.7%	3	0.8%

PC: primary care.

2.6. Statistical analysis

Data were statistically processed and analyzed using the SPSS 22.0 (SPSS Inc., Chicago, IL) software package and Microsoft Excel. Continuous data were tested for normal distribution using the Kolmogorov-Smirnov test. Descriptive statistics were presented as median and interquartile range (IQR), and percentages for continuous data and categorical data.

3. Results

The laboratory received 48,075 requests from primary care during the study period. HTN prompted laboratory testing in 3816 (7.9%) of those requests. Table 1 provides demographic information and ACR values for the total number of requests that were prompted by HTN, and those cases when ACR was automatically registered through our intervention.

Fig. 1 summarizes the strategy and shows its financial implications. Through an expense of 275.8€ the strategy ensured that all primary care patients with HTN who underwent laboratory analysis would meet appropriate ACR testing. Savings in ACR measurement through strip analysis when the ACR was requested by GPs were higher that the investment needed to measure the additional registered ACR (1450.3€ vs. 275.8€). The percentage of normal ACR values in both groups was > 85% (represented by the arrows in the figure).

4. Discussion

The proposed strategy designed from the clinical laboratory in agreement with GPs ensured an appropriate request for ACR in patients with HTN, to comply with current guideline recommendations. The strategy was cost effective and resulted in no additional expenses.

There is evidence that 15% to 54% of primary care medical errors reported by primary care physicians and their staff are related to the testing process [10,11]. Our results show that, through communication with GPs and focus on guideline recommendations, we are influencing testing by solving test under-request and therefore we could potentially

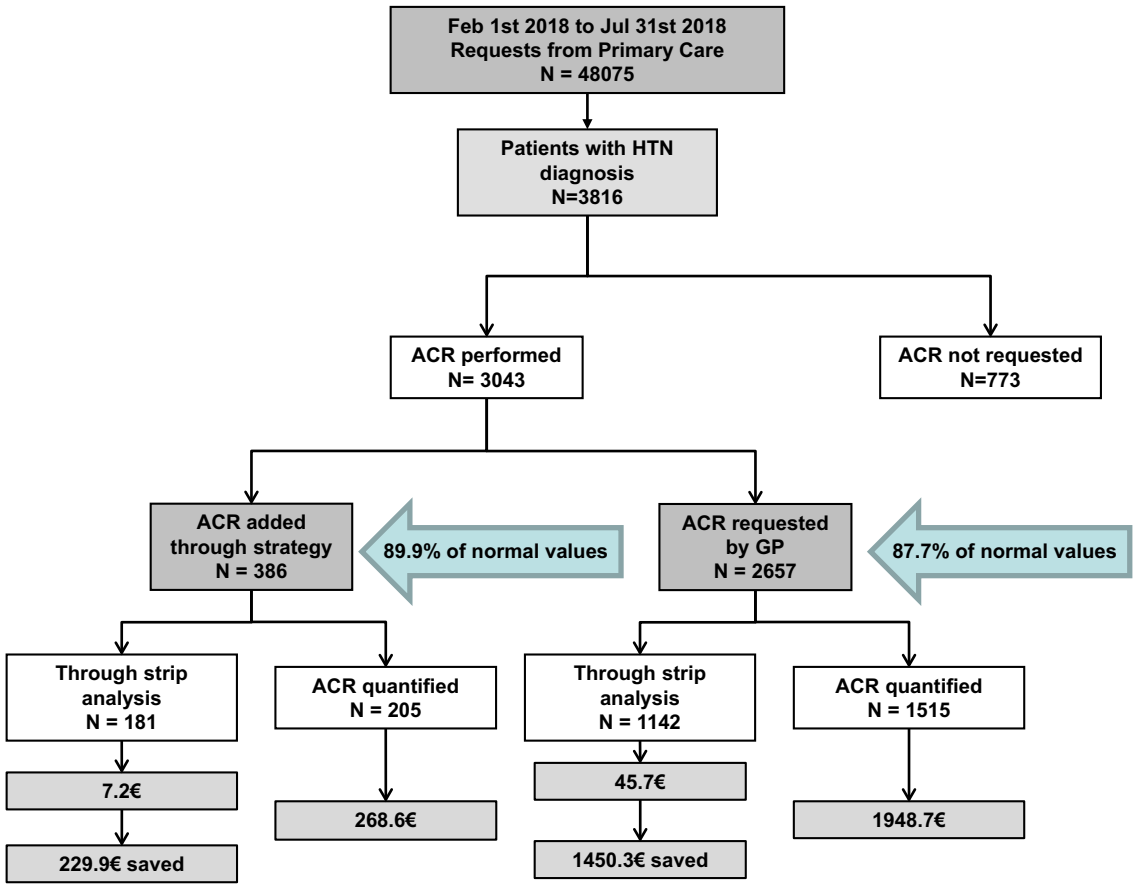

Fig. 1. ACR quantified and reported through semi-quantitative ACR strip and the respective economic costs.
HTN: Hypertension.

impact patient care [12].

HTN is a public health problem that currently affects 40% of the worldwide population [13], and there is a lack of compliance with guidelines for its management [6,14,15]. The study results show that solving urinary albumin under request might be possible at a moderate cost. The study had, however, some limitations. Despite our intervention, there were still HTN patients who did not undergo annual laboratory testing, and therefore will not benefit from our strategy. Second, our results might not be extrapolated to other populations. Third, only process metrics were evaluated in the study, and it is hard to know whether improved monitoring would influence outcome for patients with HTN. Finally, the economic assessment is simplistic, and may not apply to other countries or settings, since our laboratory belongs to the Public Health Network, a national organization where reagent prices are very low.

5. Conclusion

The laboratory can play a crucial role in the management of HTN in primary care patients and might be able to achieve a better adherence to guidelines at a moderate cost.

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Author contribution statement

Concept and design (MS, ML-G, EF, MA, CL-S); acquisition of data (ML-G, EF); analysis and interpretation of data (MS, ML-G, EF); drafting of the manuscript (MS, ML-G, EF, MA, CL-S); critical revision of the manuscript for important intellectual content (MA, CL-S); statistical analysis (ML-G, EF); administrative, technical, or logistic support (ML-G); and supervision (MS).

Declarations of interest

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References

[1] M. Salinas, M. Lopez-Garrigos, E. Flores, C. Leiva-Salinas, Pilot group of the appropriate utilization of laboratory tests, annals express: urinary albumin: a risk marker under-requested in primary care in Spain, Ann. Clin. Biochem. (2017) 000456321771647, , https://doi.org/10.1177/0004563217716475.
[2] J.R. Delanghe, J. Himpe, N. De Cock, S. Delanghe, K. De Herde, V. Stove, M.M. Speeckaert, Sensitive albuminuria analysis using dye-binding based test strips, Clin. Chim. Acta 471 (2017) 107–112, https://doi.org/10.1016/j.cca.2017.05.032.
[3] M. Salinas, M. López-Garrigós, E. Flores, J. Lugo, C. Leiva-Salinas, PRIMary care-LABoratory (PRIMLAB) working group, urinary albumin strip assay as a screening test to replace quantitative technology in certain conditions, Clin. Chem. Lab. Med.

0 (2018), https://doi.org/10.1515/cclm-2018-0546.
[4] P.M. Kearney, M. Whelton, K. Reynolds, P.K. Whelton, J. He, Worldwide prevalence of hypertension: a systematic review, J. Hypertens. 22 (2004) 11–19.
[5] G. Mancia, R. Fagard, K. Narkiewicz, J. Redon, A. Zanchetti, M. Böhm, T. Christiaens, R. Cifkova, G. De Backer, A. Dominiczak, M. Galderisi, D.E. Grobbee, T. Jaarsma, P. Kirchhof, S.E. Kjeldsen, S. Laurent, A.J. Manolis, P.M. Nilsson, L.M. Ruilope, R.E. Schmieder, P.A. Sirnes, P. Sleight, M. Viigimaa, B. Waeber, F. Zannad, M. Burnier, E. Ambrosioni, M. Caufield, A. Coca, M.H. Olsen, C. Tsioufis, P. van de Borne, J.L. Zamorano, S. Achenbach, H. Baumgartner, J.J. Bax, H. Bueno, V. Dean, C. Deaton, C. Erol, R. Ferrari, D. Hasdai, A.W. Hoes, J. Knuuti, P. Kolh, P. Lancellotti, A. Linhart, P. Nihoyannopoulos, M.F. Piepoli, P. Ponikowski, J.L. Tamargo, M. Tendera, A. Torbicki, W. Wijns, S. Windecker, D.L. Clement, T.C. Gillebert, E.A. Rosei, S.D. Anker, J. Bauersachs, J.B. Hitij, M. Caulfield, M. De Buyzere, S. De Geest, G.A. Derumeaux, S. Erdine, C. Farsang, C. Funck-Brentano, V. Gerc, G. Germano, S. Gielen, H. Haller, J. Jordan, T. Kahan, M. Komajda, D. Lovic, H. Mahrholdt, J. Ostergren, G. Parati, J. Perk, J. Polonia, B.A. Popescu, Z. Reiner, L. Rydén, Y. Sirenko, A. Stanton, H. Struijker-Boudier, C. Vlachopoulos, M. Volpe, D.A. Wood, 2013 ESH/ESC guidelines for the management of arterial hypertension: the task force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC), Eur. Heart J. 34 (2013) 2159–2219, https://doi.org/10.1093/eurheartj/eht151.
[6] A. de la Sierra, J.A. Divisón, P. Garrido, A. Barbón, R. Arístegui, En representación de los investigadores SEVIMAB, [determination of urinary albumin excretion in arterial hypertension], Rev. Clin. Esp. 212 (2012) 172–178, https://doi.org/10.1016/j.rce.2011.09.010.
[7] M. Salinas, M. López-Garrigós, E. Flores, M. Leiva-Salinas, P. Esteban, M. Ahumada, C. Leiva-Salinas, Indications for laboratory tests in primary care: assessment of the most frequent indications and requests with blank clinical information, Biochem. Medica. 26 (2016) 431–435, https://doi.org/10.11613/BM.2016.045.
[8] Centers for Disease Control and Prevention, National Center for Health Statistics, ICD - ICD-9-CM - International Classification of Diseases, Ninth Revision, Clinical Modification, Classif Dis Funct Disabil, (2013).
[9] O.J.O.S. Of, Kidney disease: improving global outcomes (KDIGO) CKD work group, KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease, Kidney Int. Suppl. 3 (2013) 4, https://doi.org/10.1038/kisup.2012.76.
[10] J.M. Hickner, D.H. Fernald, D.M. Harris, E.G. Poon, N.C. Elder, J.W. Mold, Issues and initiatives in the testing process in primary care physician offices, Jt. Comm. J. Qual. Patient Saf. 31 (2005) 81–89.
[11] S. Ferraro, M. Panteghini, The role of laboratory in ensuring appropriate test requests, Clin. Biochem. (2017), https://doi.org/10.1016/j.clinbiochem.2017.03.002.
[12] L.M. Berte, D.E. Nevalainen, Management: the laboratory's role in assessing patient outcomes, Lab. Med. 29 (1998) 114–119, https://doi.org/10.1093/labmed/29.2.114.
[13] World Health Organization, A Global Brief on Hypertension - World Health Day 2013, (2013), https://doi.org/10.1136/bmj.1.4815.882-a.
[14] C. Cuspidi, I. Michev, L. Lonati, A. Vaccarella, M. Cristofari, G. Garavelli, G. Palumbo, S. Meani, G. Leonetti, F. Magrini, A. Zanchetti, Lombardy regional section of Italian Society of Hypertension, compliance to hypertension guidelines in clinical practice: a multicentre pilot study in Italy, J. Hum. Hypertens. 16 (2002) 699–703, https://doi.org/10.1038/sj.jhh.1001468.
[15] P. Jami, P. Smith, S. Moningi, V. Moningi, S.A. Martin, G. Rosencrance, B.J. Reyes, Compliance with joint National Committee 7 guidelines in hypertension management in a teaching institution, Am. J. Med. Qual. 22 (2007) 251–258, https://doi.org/10.1177/1062860607303293.