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de Vries, Jeroen K.; van der Horst, Iwan C. C.; Gans, Rijnold O. B.; van den Born, Bert-Jan H.; Gaillard, Carlo A. J. M.; Harms, Mark P. M.

*Published in:*  
European Journal of Emergency Medicine

*DOI:*  
[10.1097/MEJ.0000000000000619](https://doi.org/10.1097/MEJ.0000000000000619)

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*  
Publisher's PDF, also known as Version of record

*Publication date:*  
2020

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

de Vries, J. K., van der Horst, I. C. C., Gans, R. O. B., van den Born, B.-J. H., Gaillard, C. A. J. M., & Harms, M. P. M. (2020). Evaluation of diagnostic and therapeutic management of hypertensive crises in a Dutch emergency department: results from a clinical audit. *European Journal of Emergency Medicine*, 27(1), 66-68. <https://doi.org/10.1097/MEJ.0000000000000619>

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None of the doctors covered all the items in the Helsinki Declaration. The participant was not always informed of his basic rights (to refuse to participate or to withdraw consent). The detailed results show that some items were not orally transmitted such as sources of funding and possible conflicts of interest. Some might consider that this information could be presented in the patient information leaflet. We believe that clarification of the means by which information is given should be mandatory to increase information quality. Moreover, the investigators could have increased the quantity of orally transmitted information as they used only half of the predefined time. Some tools such as interactive electronic consent may help physicians to improve the quality of informed consent, but they have never been tested in the specific setting of emergency and critical care [3]. Specific training especially on those items that were never addressed may help physicians maintaining the highest ethical standards [4].

Although these results must be replicated including using other protocols, it seems that the adequacy of oral information given to research participants with regards to the recommendations of the Declaration of Helsinki is low at least in the specific context of emergency and critical care.

## Acknowledgements

We thank Jean Ashok Vasdev for his assistance and Alison Foot for editing the manuscript.

M.M. had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Acquisition, analysis, or interpretation of data, revision of the manuscript for important intellectual content: all authors.

## Conflicts of interest

Dr Maignan reports grants and personal fees from MundiPharma, personal fees from Purdue, grants from Roche Diagnostics, grants from AstraZeneca, outside the submitted work. For the remaining authors, there are no conflicts of interest.

## References

- 1 Ndebele P. The Declaration of Helsinki, 50 years later. *JAMA* 2013; **310**:2145–2146.
- 2 World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA* 2013; **310**:2191–2194.
- 3 Rowbotham MC, Astin J, Greene K, Cummings SR. Interactive informed consent: randomized comparison with paper consents. *PLoS One* 2013; **8**:e58603.
- 4 Lentz J, Kennett M, Perlmutter J, Forrest A. Paving the way to a more effective informed consent process: recommendations from the clinical trials transformation initiative. *Contemp Clin Trials* 2016; **49**:65–69.

10.1097/MEJ.0000000000000618

## Evaluation of diagnostic and therapeutic management of hypertensive crises in a Dutch emergency department: results from a clinical audit

Jeroen K. de Vries<sup>a,e</sup>, Iwan C.C. van der Horst<sup>b</sup>, Rijnold O.B. Gans<sup>a</sup>, Bert-Jan H. van den Born<sup>c</sup>, Carlo A.J.M. Gaillard<sup>d</sup> and Mark P.M. Harms<sup>a</sup>, Departments of <sup>a</sup>Internal Medicine and <sup>b</sup>Critical Care, University of Groningen, University Medical Center Groningen, Groningen, <sup>c</sup>Department of Internal and Vascular Medicine, Academic Medical Centre, Amsterdam, <sup>d</sup>Division of Internal Medicine and Dermatology, University Medical Center Utrecht, Utrecht and <sup>e</sup>Department of Internal Medicine, Antonius Hospital, Sneek, The Netherlands

Correspondence to Jeroen K. de Vries, Antonius Ziekenhuis Sneek, Bolswarderbaan 1, 8601 ZK, Sneek, The Netherlands  
Tel: +31 (0)515 488888; e-mail: j.devries@antonius-sneek.nl

Received 22 October 2018 Accepted 19 June 2019

Patients with hypertensive crises (HC) frequently present in emergency departments (ED). Most international guidelines address HC only briefly, and appropriate diagnostic work-up is challenging [1,2]. Although most HC patients do not have acute hypertension-associated target-organ damage, properly identifying the minority with hypertensive emergency warrants a thorough diagnostic work-up. The Dutch guideline on HC was updated in 2010 [3]; here we report an audit of the guideline adherence in 112 patients with blood pressure >180/110 mmHg in an academic ED (Table 1).

From hospital records, we retrieved medical history, medication use, cardiovascular (CV) risk factors, ED procedures (diagnostic tests, diagnosis, treatment, follow-up arrangements) and CV events within 6 months of the ED visit. The cohort was stratified by ED diagnosis (emergency, urgency or severe hypertension) (Table 1). We compared ED procedures with guideline recommendations. Complete blood count, renal function and ECG were performed in 98%, bilirubin and albuminuria in 67% and 64%, respectively and fundoscopy, chest X-ray, fragmentocytes and haptoglobin were performed less often (40%, 32%, 15%, 10%, respectively). All tests are guideline recommendations. Interestingly, tests for microangiopathy are among the least ordered tests, whereas target-organ damage in this category is relatively common and may present without specific complaints [2].

Attending ED physicians diagnosed 13% (n = 14) of patients with hypertensive emergency. However, during chart review another 12 additional cases of hypertensive emergency were identified using the ED test results: TIA (n = 4), encephalopathy (n = 1), retinopathy (n = 3), acute heart failure (n = 2) and acute kidney failure (n = 2). Pharmacological treatment in the ED was guideline consistent in 57%, whereas in 2/14 emergency cases, no nitrate was administered for acute heart failure and in 39/85 urgency cases, an alternative drug was chosen instead of the recommended calcium channel blocker.

**Table 1 Characteristics of the cohort**

|   | All <sup>a</sup>        | ED: emergency           | ED: urgency             | ED: hypertension        |
|---|-------------------------|-------------------------|-------------------------|-------------------------|
| n   | 112                     | 14                      | 85                      | 13                      |
| <b>Baseline characteristics</b>               |                         |                         |                         |                         |
| Age (years) (±SD)                             | 58.5 (±14.7)            | 52.3 (±10.2)            | 59.5 (±14.9)            | 58.2 (±16.6)            |
| Male gender, n (%)                            | 53 (47)                 | 8 (57)                  | 38 (45)                 | 7 (54)                  |
| History of hypertension, n (%)                | 53 (47)                 | 2 (14)                  | 49 (58)                 | 2 (15)                  |
| SBP/DBP (mmHg) (±SD)                          | 212/114<br>(±23.6/22.7) | 237/113<br>(±21.8/31.5) | 207/112<br>(±21.1/20.4) | 216/111<br>(±24.2/17.8) |
| No antihypertensive drugs, n (%)              | 53 (47)                 | 12 (86)                 | 33 (38)                 | 8 (67)                  |
| One antihypertensive drug, n (%)              | 17 (15)                 | 1 (7.1)                 | 13 (15)                 | 3 (25)                  |
| Two antihypertensive drugs, n (%)             | 19 (17)                 | 1 (7.1)                 | 17 (20)                 | 1 (8.3)                 |
| Three antihypertensive drugs, n (%)           | 10 (8.9)                | 0                       | 10 (12)                 | 0                       |
| Four antihypertensive drugs, n (%)            | 11 (9.8)                | 0                       | 11 (13)                 | 0                       |
| Five antihypertensive drugs, n (%)            | 2 (1.8)                 | 0                       | 2 (2.3)                 | 0                       |
| History of DM, n (%)                          | 11 (9.8)                | 1 (7.1)                 | 9 (11)                  | 1 (7.7)                 |
| History of heart failure, n (%)               | 3 (2.7)                 | 0                       | 3 (3.5)                 | 0                       |
| Current smoking, n (%) <sup>b</sup>           | 34 (30)                 | 5 (36)                  | 24 (28)                 | 5 (39)                  |
| <b>History of CV events</b>                   |                         |                         |                         |                         |
| Coronary heart disease n, (%)                 | 9 (8.0)                 | 0                       | 9 (11)                  | 0                       |
| Stroke n, (%)                                 | 11 (9.8)                | 0                       | 10 (12)                 | 1 (7.7)                 |
| <b>ED diagnostics</b>                         |                         |                         |                         |                         |
| Complete blood count n, (%)                   | 109 (97)                | 14 (100)                | 82 (97)                 | 13 (100)                |
| Reticulocyte count n, (%)                     | 2 (1.8)                 | 2 (14)                  | 0                       | 0                       |
| Fragmentocyte count n, (%)                    | 17 (15)                 | 5 (36)                  | 12 (14)                 | 0                       |
| Lactate dehydrogenase n, (%)                  | 106 (95)                | 14 (100)                | 79 (93)                 | 13 (100)                |
| Bilirubin n, (%)                              | 75 (67)                 | 9 (64)                  | 55 (65)                 | 11 (85)                 |
| Haptoglobin n, (%)                            | 10 (8.9)                | 4 (29)                  | 6 (7.1)                 | 0                       |
| Creatinine n, (%)                             | 109 (97)                | 14 (100)                | 82 (97)                 | 13 (100)                |
| Albuminuria n, (%)                            | 72 (64)                 | 12 (86)                 | 51 (60)                 | 9 (69)                  |
| Electrocardiography n, (%)                    | 109 (97)                | 14 (100)                | 82 (97)                 | 13 (100)                |
| Chest X-ray n, (%)                            | 36 (32)                 | 10 (71)                 | 22 (26)                 | 4 (31)                  |
| Fundoscopy n, (%)                             | 45 (40)                 | 9 (64)                  | 34 (40)                 | 2 (15)                  |
| <b>ED treatment</b>                           |                         |                         |                         |                         |
| Guideline consistent n, (%)                   | 64 (57)                 | 12 (86)                 | 44 (52)                 | 8 (62)                  |
| Guideline inconsistent n, (%)                 | 46 (41)                 | 2 (14)                  | 39 (46)                 | 5 (39)                  |
| Unknown n, (%)                                | 2 (1.8)                 | 0                       | 2 (2.4)                 | 0                       |
| <b>Cardiovascular events during follow-up</b> |                         |                         |                         |                         |
| Any cardiovascular event n, (%)               | 9 (8.0)                 | 2 (14)                  | 7 (8.2)                 | 0                       |
| Coronary heart disease/CABG n, (%)            | 2 (1.8)                 | 1 (7.1)                 | 1 (1.2)                 | 0                       |
| Congestive heart failure n, (%)               | 1 (0.9)                 | 0                       | 1 (1.2)                 | 0                       |
| Aortic dissection and aneurysm n, (%)         | 1 (0.9)                 | 1 (7.1)                 | 0                       | 0                       |
| Increase CKD stage n, (%)                     | 1 (0.9)                 | 0                       | 1 (1.2)                 | 0                       |
| Stroke and encephalopathy n, (%)              | 3 (2.7)                 | 0                       | 3 (3.5)                 | 0                       |
| Death (elective aneurysm repair) n, (%)       | 1 (0.8)                 | 0                       | 1 (1.2)                 | 0                       |
| <b>Other relevant events n, (%)</b>           |                         |                         |                         |                         |
| Recurrent hypertensive crisis n, (%)          | 11 (9.8)                | 3 (21)                  | 7 (7.7)                 | 1 (7.1)                 |
| Uncontrolled hypertension (outpatient) n, (%) | 17 (15)                 | 2 (14)                  | 12 (14)                 | 3 (23)                  |
| Uneventful follow-up n, (%)                   | 47 (40)                 | 6 (43)                  | 35 (41)                 | 4 (31)                  |
| GP referral/lost to follow-up n, (%)          | 32 (29)                 | 1 (7.1)                 | 24 (28)                 | 5 (39)                  |

CABG, coronary artery bypass grafting; CV, cardiovascular; CKD, chronic kidney disease; DM, diabetes mellitus; ED, emergency department; GP, general practitioner; TIA, transient ischemic attack.

<sup>a</sup>Data are mean ± SD or n (%); percentages may not add up to 100% due to rounding.

<sup>b</sup>Missing data in 23 patients (emergency: n = 1, urgency: n = 21, hypertension: n = 1).

The charts did not clarify the reasons for deviation from the guideline; however, pharmacological treatment can be challenging in patients already using multiple drugs and deviation from the guideline could reflect proper decision-making.

After ED visit, 29% was referred back to the general practitioner and lost to follow-up. Forty percent experienced no adverse events and 15% had insufficiently controlled hypertension. Readmission for HC occurred in 10% after a median of 27 (interquartile range 15–105) days. Nine patients (8%) suffered a CV event: unstable angina (n = 1), coronary artery bypass grafting

(n = 1), congestive heart failure (n = 1), aortic dissection (n = 1), renal failure (n = 1), stroke (n = 2), death from elective aortic aneurysm repair (n = 1, aneurysm identified before ED visit for HC).

This clinical audit highlights several points. First, HC guideline recommendations are insufficiently adhered to, especially with respect to the diagnostic recommendations. Our data does not settle the debate, which subgroup of patients would benefit from extensive or limited screening for hypertension-related target-organ damage. However, we do show that hypertension-associated target-organ damage and hypertensive emergencies are not

rare among HC patients. In all reality, it might not be possible to separate patients with hypertensive emergency from those with urgency without thorough additional testing.

Also, the 8% CV event rate during 6 months of follow-up suggests that this is a high CV risk population. This is in line with previous work [4], which highlights the lack of clustering of hypertension from other CV risk factors in patients with HC. For obvious reasons, subsequent treatment should reflect the high-risk status of HC patients, although no prospective study has evaluated whether intensive treatment of CV risk factors in this group leads to better CV outcomes.

Our findings stress the need for further evaluation of very high CV risk patients presenting with an HC as well as the need for multi-center cohort studies with emphasis on HC management.

## Acknowledgements

### Conflicts of interest

There are no conflicts of interest.

## References

- 1 Karras DJ, Kruus LK, Cienki JJ, Wald MM, Ufberg JW, Shayne P, *et al.* Utility of routine testing for patients with asymptomatic severe blood pressure elevation in the emergency department. *Ann Emerg Med* 2008; **51**:231–239.
- 2 Van den Born BJ, Honnebiér UP, Koopmans RP, Van Montfrans GA. Microangiopathic hemolysis and renal failure in malignant hypertension. *Hypertension* 2005; **45**:246–251.
- 3 Van den Born BJ, Beutler JJ, Gaillard CA, De Gooijer A, Van den Meiracker AH, Kroon AA. Dutch guideline for the management of hypertensive crisis—2010 revision. *Neth J Med* 2011; **69**:248–255.
- 4 Amraoui F, Van der Hoeven NV, Van Valkengoed IG, Vogt L, Van den Born BJ. Mortality and cardiovascular risk in patients with a history of malignant hypertension: a case-control study. *J Clin Hypertens (Greenwich)* 2014; **16**:122–126.

10.1097/MEJ.0000000000000619