

# Excessive anticoagulation identified by emergency medical service through point-of-care coagulometry

---

BY CHRISTOPHER BEYNON, ANGELINA G ERK, STEFAN MOHR, FELIX HEISER, ERIK POPP

## Abstract

Bleeding because of excessive anticoagulation is a well-recognized complication of coumadin therapy. In cases of potentially life-threatening bleeding such as intracranial haemorrhage, reversal of anticoagulation should be carried out as soon as possible. Here we report the case of an emergency patient in whom excessive anticoagulation was diagnosed at the scene by emergency medical service personnel through the use of a point-of-care coagulometer. Following hospital admission, findings were confirmed by central laboratory assessment of prothrombin time. The time gained through the use of portable coagulometers may contribute to improved pre-hospital emergency management of anticoagulated patients.

Key words: anticoagulation, bedside testing, warfarin, haemorrhage

## Introduction

Bleeding diatheses can have a crucial impact on the outcome of emergency patients. Antithrombotic medication is increasingly administered to patients with cardiovascular diseases. In emergency scenarios such as acute trauma, treatment with anticoagulants has been associated with an unfavourable patient outcome and increased mortality. (1) Point-of-care (POC) devices for rapid assessment of

prothrombin time (PT) have been developed for patient self-monitoring of anticoagulant therapy. These devices use capillary blood from a finger prick and deliver PT test results within one minute. Various studies have investigated the accuracy of POC PT devices and demonstrated that test results are highly correlated with results from conventional assessment in central laboratories. (2) The introduction of these devices has improved patients' quality of life and reduced the time required for anticoagulation monitoring. (3)

Several studies on the in-hospital use of POC PT devices have been reported recently. (4) Management of anticoagulated patients with acute neurologic emergencies such as stroke or intracranial haemorrhage can be expedited by earlier assessment of coagulation status. The pre-hospital use of POC PT devices may improve treatment modalities in anticoagulated patients with medical emergencies. Here we describe the pre-hospital use in a patient with acute bleeding who was treated by emergency medical service (EMS). Excessive anticoagulation was diagnosed at the scene and PT results were available more than one hour earlier compared with central laboratory (CL) examination. Although the diagnosis did not have a direct impact on the treatment and outcome of this patient, the potential value of this device in pre-hospital emergency care is demonstrated.

## Case report

Following an emergency call for acute haemorrhage, an emergency medical service team arrived at the residence of a 90-year-old male patient. The patient reported that he had repetitive bleeding from his nose and throat in the last days and exacerbation of bleeding had led to the emergency call. On clinical examination, there were no signs of active bleeding and the patient's systolic blood pressure was 120 mmHg. His past medical history included myelodysplastic syndrome and atrial fibrillation for which he was treated with the coumadin anticoagulant phenprocoumon. Following venopuncture for insertion of an intravenous line, a drop of blood was collected from the puncture device for the assessment of PT through the POC device CoaguChek XS® (Roche Diagnostics, Mannheim, Germany, figure 1). An error message was displayed by the device and therefore, blood was drawn from the intravenous line for repeated measurement. Within one minute after blood application on the test strip, the device displayed an International Normalized Ratio (INR) of 8.0, indicating excessive

anticoagulation. After transportation of the patient to the emergency department of our tertiary hospital for further treatment, blood was drawn for CL assessment of various parameters (table 1). Prothrombin time assessed by CL examination was  $INR > 7.0$ , confirming the previously established diagnosis of excessive anticoagulation. Furthermore, laboratory values were suggestive of acute renal failure and showed severe leucocytosis, possibly because of secondary acute myeloid leukaemia. Following discussion with physicians and near relatives regarding his clinical situation, the patient chose to receive comfort measures only. Vitamin K was administered intravenously and INR was 3.3 in a blood sample drawn 8 hours later. The patient died on the 4th day after hospital admission.

As the population ages, emergency physicians increasingly encounter patients with coagulopathy secondary to treatment with antithrombotic medication. POC devices for patient self-monitoring of anticoagulation are increasingly used in emergency departments of hospitals. The considerable gain of time hastens the further management of patients suffering from acute ischaemic stroke or from conditions requiring urgent neurosurgical intervention. (4) Recently, the prehospital use of the CoaguChek XS® was also reported by a Helicopter Emergency Medical Service for PT assessment in an anticoagulated head-injured patient who received prothrombin complex concentrate (PCC) at the scene of the accident. (5)

The value of this device in pre-hospital emergency care is also demonstrated by our report as excessive anticoagulation was diagnosed at the scene. Although bleeding had stopped in the haemodynamically stable patient when EMS personnel arrived, this diagnosis may have hastened the management in the emergency department if haemorrhage had recurred. Furthermore, PCC or recombinant factor VIIa could have been administered at the scene or during transport to the hospital as these drugs do not have to be thawed and are readily available. If the patient's care had not been directed to comfort measures only, excessive anticoagulation may have been treated more aggressively. Guidelines recommend the use of haemostatic substances in order to restore haemostasis in anticoagulated patients with severe bleeding. (6) We are aware that the patient's bleeding complication may have also been caused by severe thrombocytopenia, which is not reflected by PT.

Various studies have demonstrated a good correlation of CoaguChek XS® results with CL assessment in anticoagulated patients. Nevertheless, limitations of these

devices have also been reported. Prosthetic heart valve thrombosis developed in a patient following false PT assessment by the older-generation CoaguChek S®. (7) Furthermore, the accuracy of PT assessment in non-anticoagulated patients is unclear. Although promising reports have emerged regarding POC coagulometry in the treatment of trauma victims in a military hospital, (8) Mitra et al. have demonstrated an inadequate agreement between CoaguChek XS® results and conventional assessment of PT in major trauma patients suffering from traumatic coagulopathy. (9)

Despite these limitations, in our view the prehospital use of POC coagulometry may represent a suitable technique to identify excess anticoagulation in emergency patients treated with coumadins. Further studies are needed to define its potential to improve prehospital emergency care of anticoagulated patients.

## Conclusion

Impaired haemostasis because of antithrombotic medication is common. The use of POC PT devices allow instant assessment of anticoagulation status and can identify excess anticoagulation and therefore, their use in pre-hospital emergency care may improve treatment modalities of respective patients.

Table 1. Results of point-of-care (POC) and central laboratory (CL) assessment of haemostatic parameters.

	Reference values			
	POC 5:45 am	CL 6:55 am	CL 2:45 pm	
INR	<1.2	8.0	>7.0	3.18
Quick	70-125%	-	<10%	18.5 %
aPTT	<35 s	-	-	35.5 s
Platelet count	150-440 /nl	-	14/nl	-
Haemoglobin	13-17 g/dl	-	9.6 g/dl	-

aPTT: activated partial thromboplastin time, INR; international normalized ratio.

Figure 1. The CoaguChek XS® device is a portable device which uses disposable test strips for INR (international normalized ratio) assessment within two minutes.



## References

1. Karni A, Holtzman R, Bass T, Zorman G, Carter L, Rodriguez, et al. Traumatic head injury in the anticoagulated elderly patient: a lethal combination. *Am Surg* 2001;67:1098–100.
2. Bereznicki LR, Jackson SL, Peterson GM, Jeffrey EC, Marsden KA, Jupe DM. Accuracy and clinical utility of the CoaguChek XS portable international normalised ratio monitor in a pilot study of warfarin home-monitoring. *J Clin Pathol* 2007;60:311–4. doi:10.1136/jcp.2006.037820
3. Verret L, Couturier J, Rozon A, Saudrais-Janecek S, St-Onge A, Nguyen A, et al. Impact of a pharmacist-led warfarin self-management program on quality of life

- and anticoagulation control: a randomized trial. *Pharmacotherapy* 2012;32:871–9. doi:10.1002/j.1875-9114.2012.01116
4. Beynon C, Jakobs M, Rizos T, Unterberg AW, Sakowitz OW. Rapid bedside coagulometry prior to urgent neurosurgical procedures in anticoagulated patients. *Br J Neurosurg* 2014;28:29–33. doi:10.3109/02688697.2013.869549
  5. Lendrum RA, Kotze J-P, Lockey DJ, Weaver AE. Case studies in prehospital care from London HEMS: pre-hospital administration of prothrombin complex concentrate to the head-injured patient. *Emerg Med J* 2013;30:247–8. doi:10.1136/emmermed-2012-202302
  6. Spahn DR, Bouillon B, Cerny V, Coats TJ, Duranteau J, Fernandez-Mondejar E, et al. Management of bleeding and coagulopathy following major trauma: an updated European guideline. *Crit Care* 2013;17:R76. doi:10.1186/cc12685
  7. Van den Brule JMD, Romkes JH, Brouwer MA, Noyez L. An error in the CoaguChek S device results in prosthetic heart valve thrombosis. *Interact Cardiovasc Thorac Surg* 2010;11:123–4. doi:10.1510/icvts.2010.233288
  8. Cotte J, D'Aanda E, Chauvin V, Kaiser E, Meaudre E. Point-of-Care Coagulation Testing for Trauma Patients in a Military Setting: A Prospective Study. *J Spec Oper Med* 2013;13:59–62.
  9. Mitra B, O'Reilly G, Collecutt M, Cameron PA, Phillips L, Davis A. Prospective comparison of point-of-care international normalised ratio measurement versus plasma international normalised ratio for acute traumatic coagulopathy. *Emerg Med Australas* 2012;24:363–8. doi:10.1111/j.1742-6723.2012.01556.x

Christopher Beynon, Angelina G Erk  
Department of Neurosurgery, Heidelberg University Hospital, Heidelberg, Germany  
Angelina G Erk, Stefan Mohr, Felix Heiser, Erik Popp  
Department of Anaesthesiology, Heidelberg University Hospital, Heidelberg, Germany  
Corresponding author:  
Christopher Beynon  
Department of Neurosurgery  
Heidelberg University Hospital  
Im Neuenheimer Feld 400  
69120 Heidelberg  
Germany  
Phone: 0049-6221-5636173  
E-mail: christopher.beynon@med.uni-heidelberg.de