Haematologica 2000; 85:826-831
original paper

Hemostasis & Thrombosis

Assessment of patient capability to self-adjust oral anticoagulant dose: a multicenter study on home use of a portable prothrombin time monitor (COAGUCHECK)

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ABSTRACT

***Background and Objectives*. Self-testing and self-monitoring with portable prothrombin time (PT) monitors has been shown to be feasible and safe. However the ability of patients on chronic oral anticoagulant therapy (OAT) to self-adjust their dose without specific training has never been properly evaluated. The aims of this study were to evaluate: 1) the ability of patients on chronic OAT to self-adjust their dose without specific training; 2) the integration of a portable PT monitor (Coagucheck, Roche Diagnostics, Germany) for home use into routine patient care in anticoagulation clinics.**

***Design and Methods.* A nested case-control study was conducted in four centers of the Italian Federation of Anticoagulation Clinics (FCSA). Patients (n=78) on stable OAT for at least 6 months (cases: 47 men, 31 women, age range: 18-75 years) were enrolled on a volunteer basis after passing an Abbreviated Mental Test and providing informed consent. After three instruction sessions on the use of Coaguchek, subjects performed the PT test at home, communicated the INR results to the Center and suggested the dose adjustment and date for next control as they thought appropriate. However, they were requested to follow the prescription made by the Center. Controls (78 subjects) matched by age (± 5 years), sex and therapeutic range with the cases, were selected from among those who attended the anticoagulation clinics and managed by usual care.**

***Results.* When compared with the dose prescribed by the Clinic, the dose suggested by warfarin and acenocoumarol users was equal to or within ± 6% of the mean weekly dose in 80% and 82% of suggestions, respectively. Time spent in the therapeutic range during the study was the same (80%) for cases and controls.**

***Interpretation and Conclusions*. Selected patients on chronic anticoagulant therapy can acquire a satisfactory ability for self-adjustment of OAT dose without specific training.**

Key words: oral anticoagulants, prothrombin time, point-of-care testing, venous thromboembolism, warfarin, acenocoumarol

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Patients on chronic oral anticoagulant therapy (OAT) require regular monitoring of the prothrombin time (PT) and mandatory individual dose adjustment to ensure that the PT remains within the therapeutic range.[1] To improve the efficacy and safety of OAT, outpatient clinics devoted entirely to oral anticoagulant control have been developed in several countries.[2-4] However, homebound patients, those who live far from a clinic and those with a regular job may find frequent testing difficult and time consuming. In patients with poor venous access, such as cancer patients and children even experienced phlebotomists may find it problematic to obtain adequate venipunctures. These difficulties may hamper satisfactory patient compliance and anticoagulation control, thus exposing patients to an increased risk of bleeding or thromboembolic complications.

Portable monitors, that perform coagulation tests from capillary blood, allow patients to test at home from a drop of whole blood obtained from a fingerstick.[5] Home PT monitoring has potential advantages over PT laboratory monitoring: 1) it may reduce the inconvenience of periodic visits to anticoagulation clinics; 2) it allows self-testing and self-adjustment of the anticoagulant dosage, which may improve patient compliance and anticoagulation control.

Several studies have shown that the accuracy of portable PT monitors is satisfactory[6] and that self-testing at home is feasible.[7] Randomized studies[8-12] have also shown the feasibility of patient self-monitoring after adequate instruction of the patients. Patients on chronic OAT who are managed by an Anticoagulation Clinic do not receive routine specific training on dose self-adjustment. However these patients may acquire such ability even without specific training during the time spent under the surveillance of an anticoagulation clinic. The ability of patients on chronic OAT to self-adjust their doses without specific training has not been properly evaluated yet. The aims of our study were the following: 1) to evaluate the ability of patients on chronic OAT to self-adjust the anticoagulant dose without specific training; 2) to evaluate the potential integration of a portable PT monitor with the routine work of anticoagulation clinics.

Experimental design

Nested case-control study in four Italian anticoagulation clinics (Centers) active in Bologna, Cremona, Milan, Padua, and belonging to the Italian Federation of Anticoagulation Clinics (FCSA, Federazione Centri Sorveglianza Anticoagulati).

Design and Methods

Study subjects

A random list of patients who regularly attended the four participating Centers and who were on stabilized OAT for at least 6 months was obtained from the electronic database available in each Center. After a telephone contact, consecutive patients were enrolled on a volunteer basis. Before enrollment in the study, the Hodkinson's Abbreviated Mental test (AMT)[13] was administered to each eligible patient to evaluate information-memory and concentration levels. Exclusion criteria were the following: 1) age less than 18 years and greater than 75 years, 2) failure at the AMT, 3) visual or manual impairment to perform self-testing (e.g. hand tremor), 4) failure to obtain informed consent. Controls, matched by age (± 5 y), sex and therapeutic range with the cases, were selected from among those who attended the Center regularly for chronic OAT therapy surveillance. In the participating centers, it is a routine procedure to instruct patients in the initial phase of treatment on the relevant aspects of OAT: mechanism of action, control of anticoagulation level and effects of over- or under-dosage, INR meaning, specific INR target and therapeutic ranges, habit and diet effects, drug interactions, etc. However, subjects enrolled in our study received no specific instructions or detailed algorithms to adjust the anticoagulant dose according to INR results.

Study intervention

The study consisted of a one-month instruction phase, followed by a six-month surveillance phase.

Instruction phase. The patients were instructed in the use of a portable PT monitor (Coagucheck, Roche Diagnostics, Germany) by physicians and nurses in each of the participating Centers. Three training sessions were conducted in each center. Patients were allowed to proceed with the study after the performance of the test had been judged satisfactory by the instructors in the last training session. No home practice between training sessions was allowed. Patients were then provided with the PT monitor Coagucheck, a finger stick device (Softclix II, Boehringer Mannheim, Mannheim, Germany), disposable sterile lancets and a box of 12 PT cartridges.

Anticoagulant therapy surveillance phase. On the day of each scheduled PT control the patients were required to perform the PT test by Coagucheck at home and then communicate the resulting INR value to the center preferably by fax, using a standard form to be filled in. The patients were requested to fill in the form with their suggestion about the weekly OAT dose (divided in 7 days) for the next period and the date for the next PT control as they thought appropriate on the basis of the obtained INR result. Patients were also asked to fill in a questionnaire regarding their general health conditions, any variation in OAT that might have occurred and any concomitant drug assumption. The physician in charge at the Center prescribed the anticoagulant dosage and scheduled the next PT control on the basis of the INR received from patients, without any knowledge of suggestions made by patients. Particular care was taken to avoid that the patients had prior knowledge of the dose and date for the next PT control indicated by the clinic. The patients were explicitly requested: a) to follow the prescription of the OAT dose and the date of the next control scheduled by the anticoagulation clinic, and b) to refer to the clinic directly (personally or by phone) whenever they thought it necessary. At the end of the study period, patients were asked to answer a self-administered questionnaire designed to determine their attitude toward the portable monitor.

Controls were managed by regular anticoagulation clinic care. The latter entails periodic visits and OAT dose adjustment by the clinic on the basis of INR results of PT measured by the anticoagulation clinic laboratory. The same physicians adjusted the dose for controls and for cases.

The study protocol was approved by the Ethics Committee of Research involving Human Subjects at each of the four centers involved in the study.

Study outcome measures

Anticoagulant therapy surveillance phase. The primary outcome measure was the ability of patients to self-adjust their OAT dose without specific training. The capability of patients for self-adjustment was evaluated by calculating the following: 1) the absolute and percent difference between the weekly dose suggested by the patients and the weekly dose prescribed by the Center; 2) the difference between the date of the next control suggested by the patients and the date scheduled by the Clinic.

For the purpose of this study, we chose to evaluate the differences between patient suggestions and clinic prescriptions on the basis of both an absolute difference cut-off and a percent difference cut-off.

Only 5 mg strength tablets of warfarin are available in Italy and all patients on acenocoumarol were using 4 mg strength tablets. Thus patients were accustomed to receive prescriptions of a minimum of a quarter of a tablet. As a result, the absolute difference which corresponds to the smallest possible variation in dosage was ±1.25 mg/week for warfarin and ±1 mg/week for acenocoumarol. Variations of 1 mg acenocoumarol may have a greater effect on the INR than variations of 1.25 mg warfarin, because the potency ratio between acenocoumarol and warfarin is approximately 2:1. As a result, an absolute difference of ±2.5 mg/week of warfarin was considered equivalent to a variation of ±1 mg/week of acenocoumarol. The percent difference between the weekly dose suggested by the patients and the weekly dose prescribed by the Center was considered significant when it was greater than ±6%. This percent difference cut-off was chosen arbitrarily.

The agreement between the dose suggested by the patients and the dose prescribed by the Clinic was also evaluated in relation to the mean weekly dose as prescribed by the Center.

The secondary outcome measure was quality of anticoagulant control. The latter was evaluated as the following: 1) the percentage of time the patients spent in the therapeutic range during the study period; 2) mean squared INR deviation. The latter was calculated as defined by Sawicki *et al*.[9] using the following equation: [INR-1/2 (upper value of target INR range + lower value of target INR range]2.

The percentage of time the patients spent in the therapeutic range during the 6 months of the study was compared with: a) the percentage of time spent in the therapeutic range by the same patients in the previous 6 months; b) the percentage of time spent in the therapeutic range by the controls during the study period.

The tertiary outcome measures were the following: 1) bleeding complications (classified as described elsewhere;[4] 2) thromboembolic events; 3) the mean number of INR determinations during the study period; 4) results of the self-administered questionnaire at the end of the study.

Statistical analysis

Data are expressed as mean ± 95% confidence intervals. Data analyses included Mann-Whitney U test, paired t-test, Fisher's exact test and the chi-squared test when appropriate. The percentage of time spent with the INR in the therapeutic range was calculated according to the method of Rosendaal *et al*.[14] using the software kindly donated by Dr. F.R. Rosendaal.

A two-tailed *p* value of less than 0.05 was considered statistically significant. The statistical analyses were conducted with the statistical package SOLO (BMDP Statistical Software, Los Angeles, CA, USA).

Results

Study subjects

Ninety-six subjects who were regularly attending the four anticoagulation clinics volunteered to participate in the study. Eighteen patients were excluded during the enrollment and instruction phases for the following reasons: failure at the Abbreviated Mental test (n=6), withdrawal of consent to participate (n=4); manual impairment (n=2); hospitalization (n=2); finger-stick impossible because of too thick skin (n=1); treatment suspension (n=1); diagnosis of cancer (n=1); positive HIV testing (n=1). Seventy-eight subjects were enrolled in the study and 78 subjects matched by age (± 5 years), sex and therapeutic range with the cases were selected as controls. Baseline characteristics of the study patients (cases) and controls are illustrated in Table 1. The mean age of cases and controls was 53.7 and 55.5 years, respectively (a non-significant difference). The mean duration of OAT therapy at the time of enrollment was 5.6 years (range: 9.6 months-17.5 years) for cases and 5.8 years (range: 6 months-22.5 years) for controls. The education level ranged from 8th grade to doctorate degree.

Surveillance phase

Ability of patients to self- adjust the OAT dose. Patients suggested a weekly dose in 86% of INR determinations (695/808). The patients were more willing to suggest a weekly dose when the INR was within (93% of the times) than when it was above (83%) or below (87%) the therapeutic range. The ability acquired by patients to self-adjust the dose was assessed by calculating the absolute difference between the dose suggested by the patients and that prescribed by the Center (Table 2). The weekly dose indicated by warfarin users was equal to the dose prescribed by the clinic in 28% of suggestions. The differences (under- or over-estimation) were within 1.25 mg/week in 47% of suggestions, between 1.25 and 2.5 mg/week in 11% of suggestions and greater than 2.5 mg/week in 13% of suggestions. Overall the weekly dose suggested by warfarin users was equal to or within ± 2.5 mg of the dose prescribed by the center in 86% of suggestions. The weekly dose indicated by acenocoumarol users was equal to the dose prescribed by the center in 53% of suggestions. The rate of concordance was significantly greater than in warfarin users ($p<0.0001$). The differences (under- or over-estimation) were within 1 mg/week in 37.8% of suggestions, between 1 and 2 mg/week in 5.5% of suggestions and greater than 2 mg/week in 3.7% of suggestions. Overall the weekly dose suggested by the patients was equal to or within ± 1 mg of the dose prescribed by the Center in 90.8% of suggestions.

The agreement between the dose suggested by the patients and the dose prescribed by the Center was also evaluated in relation to the mean weekly dose of anticoagulant prescribed by the Centre during the surveillance phase. Warfarin users were divided into three groups: those taking a weekly dose lower than 20 mg (7/49-14%), between 20 and 35 mg (19/49 - 39%) and greater than 35 mg (23/49-47%). The proportion of dose suggestions concordant or within ± 2.5 mg/week when compared with the dose pre-

Table 1. Baseline characteristics of study patients.

	Cases	*Controls*	*p*
Sex (M/F)	47/31	44/34	ns
Age range in years	18-75	25-75	
Mean age (95% CL)	53.7 (51.1-56.6)	55.5 (52.9-58.1)	ns
Duration of OAT years, mean (95% CL)	5.6 (4.7-6.5)	5.8 (4.7-6.9)	ns
OAT duration (range in y)	0.8-17.5	0.5- 22.5	
Targeted therapeutic range			
INR: 2-3.5	47/78=60%	52/78= 67%	ns
INR: 2.5-4.5	31/78=40%	26/78= 33%	
Acenocoumarol users	29/78= 37%	18/78= 23%	ns
Range 2-3.5	13/29= 45%	11/18= 61%	ns
Range 2.5-4.5	16/29= 55%	7/18= 39%	
Warfarin users	49/78= 63%	60/78= 77%	ns
Range 2-3.5:	34/49= 70%	41/60= 68%	ns
Range 2.5-4.5	15/49= 30%	19/60= 32%	
Indications for OAT therapy			
prosthetic heart valve	31	28	ns
venous thromboembolism	18	17	ns
atrial fibrillation	7	6	ns
other	22	27	ns

Table 2.

	Warfarin	*Acenocoumarol*	*p**
No. determinations:	493	315	
Dose suggestion in:	425/493 (86.2%)	270/315 (85.7%)	
Concordant:	28%	53%	<0.0001
Underestimation:			
</= 1.25 mg/w	26%	</= 1 mg/w	21.5%
1.25-2.5 mg/w	7%	1-2 mg/w	1.8%
> 2.5 mg/w	9 %	> 2 mg/w	1.5%
Overestimation:			
</= 1.25 mg/w	21%	</= 1 mg/w	16.3%
1.25-2.5 mg/w	4%	1 mg-2 mg/w	3.7%
> 2.5 mg/w	5%	> 2 mg/w	2.2%

**Fisher's exact test.*

Table 3. Agreement between the dose suggested by the patient and the dose prescribed by the center according to the mean weekly dose prescribed by the center over the study surveillance phase.

WARFARIN	*< 20 mg/wk (7 pts)*	*20-35 mg/wk (19 pts)*	*>35 mg/wk (23 pts)*
No difference or dose within ± 2.5 mg/week			
% of suggestions	86.8%	87.2%	88.8%
(n. of suggestions/total suggestions)	(53/61)	(137/157)	(184/207)*
No difference or dose within ± 6% of the weekly dose			
% of suggestions	54%	75.1%	90.3%
(n. of suggestions/total suggestions)	(33/61)	(118/157)	(187/207)**
ACENOCOUMAROL	*< 15 mg/wk (7 pts)*	*15-22 mg/wk (11 pts)*	*>22 mg/wk (11 pts)*
No difference or dose within ± 1 mg/week			
% of suggestions	91.2%	90%	91.5%
(n. of suggestion/total suggestions)	(52/57)	(96/107)	(97/106)§
No difference or dose within ± 6% of the weekly dose			
% of suggestions	63.1%	81.3%	92.4%
(n. of suggestion/total suggestions)	(36/57)	(87/107)	(98/106)#

*Wk: week. *χ^2 test: p= 0.22 among groups of warfarin users; **χ^2 test: p <0.001 among groups of warfarin users; §χ^2 test: p= 0.89 among groups of acenocoumarol users; #χ^2 test: p =<0.001 among groups of acenocoumarol users.*

Table 4. Suggestions for the date of the next control when compared to the date scheduled by the Center.

Suggestions: 83% (671/808)	
Concordant	27.1% (182/671)
Brought forward Mean 5 days	34.4% (231/671)
Postponed Mean 6 days	38% (255/671)

scribed by the Center was similar among these three groups (Table 3). However, the proportion of dose suggestions equal to or within ± 6% of the dose prescribed by the Center increased significantly from the lowest to the highest mean weekly dose group (chi-square p<0.0001).

Acenocoumarol users were divided into three groups: those taking a weekly dose lower than 15 mg (7/29 - 24%), between 15 and 22 mg (11/29-38%) and greater than 22 mg (11/29-38%). The proportion of dose suggestions concordant or within ± 1 mg/week when compared with the dose prescribed by the Center was similar among these three groups (Table 4). However, the proportion of dose suggestions equal to or within ± 6% of the dose prescribed by the Center increased significantly from the lowest to the highest mean weekly dose group (chi-square p <0.0001).

When patients omitted the dose suggestion (113 times), the monitor INR was above, below and within the therapeutic range in 29% (33/113), 30% (34/113) and 41% (46/113) of cases, respectively. Among the 33 monitor PT values above the therapeutic range, 11 were greater than 5 INR units and patients omitted a dose suggestion 6 out of 11 times (55%).

Difference between the date suggested by the patients for the next PT control and that scheduled by the clinic. A date for the next PT control was suggested by the patients 83% of the times (Table 4). The date indicated for next PT control was concordant with that scheduled by the Center in 27.1% suggestions, it was earlier (by a mean of 5 days) in 34% of suggestions and postponed (by a mean of 6 days) in 38% of suggestions.

Quality of anticoagulation control. During the study period, both cases and controls spent 80% of the time with an INR in the therapeutic range (Table 5). In the 6 months preceding the study, cases spent 80.5% of the time with an INR in the therapeutic range. The INR was above the therapeutic range in the cases for longer during the study than in the previous 6 months (6.4% vs. 5.5%) and for less time than in the controls (6.4% vs. 9.5%) but these differences were not significant. The time spent by cases with an INR below the therapeutic range during the study was higher than in controls (13.6% vs. 9.8%) but the difference was not significant. The mean INR square deviation was 0.89 (95% confidence limits: CL: 0.79-0.99) and 0.92 (95% CL: 0.77-1.06) for cases during the study and in the previous 6 months, respectively (p > 0.05). The mean INR square deviation during the instruction phase was 0.89 (95% CL: 0.79-0.99). The mean square INR deviation was 1.15 (95% CL: 0.82-1.47) for controls during the study and this was not significantly different from the mean square INR deviation for cases.

During the study period, the mean number of INR determinations was 11.7 for cases and 11.5 for controls, a non-significant difference.

Bleeding and thrombotic complications. No major bleeding events were recorded during the study. Among cases, two episodes of minor bleeding (epistaxis) were recorded. In one case the INR value was 1.47, in the other case INR was 2.7 but concomitant assumption of piroxicam was reported. Among controls, two

Table 5. Percentage of time spent within, below and above the therapeutic range.

	Group 1 Cases in previous 6 months	*Group 2 Cases during the study*	*Group 3 Controls during the study*
In range	80.5%	80%	80.5%*
Above	5.5%	6.4%	9.5%*
Below	14.5%	13.6%	9.8%*

**No difference between groups 1, 2 and 3.*

episodes of minor bleeding were also recorded: hematuria in a patient with an INR of 2.2 and epistaxis in one with an INR of 3.9. During the study period, one patient (case) experienced a non-fatal acute myocardial infarction. The following adverse events were also recorded during the study period: one case with a prosthetic heart valve had an aortic dissection and underwent surgery; one case had a limb amputation (due to worsening of peripheral obstructive arterial disease, INR values not available); a sudden death occurred in a case with known coronary artery disease (10 days after discontinuation of OAT therapy and start of anti-platelet therapy; post-mortem not performed).

Attitude of patients towards the portable monitor. Two patients withdrew their consent to participate in the study during the surveillance phase: one patient after two months because he was not feeling confident in the monitor results, the other after 5 months because she was getting too anxious to use the monitor.

The majority of patients (93%) judged the monitor easy to use and declared (76%) they were confident in the monitor results. However, 52% of patients were worried that the results given by the monitor could be very different from those given by the laboratory. About two-thirds (63%) declared that the monitor had made the treatment with OAT more acceptable and easier to comply with (65%). Twenty-seven percent of the patients declared they would be confident to self-adjust the OAT dose. The majority (80%), however, expressed the preference to keep the monitor for self-testing but have the dose prescribed by the clinic.

Discussion

Several studies have shown the feasibility of both self-testing and self-adjustment with Coagucheck. In particular, three randomized controlled studies have been performed in the Netherlands,[8] in Germany[9] and in Austria.[10] In all three studies patients were randomized to self-testing and self-monitoring after a structured teaching program. In the study by Cromheecke *et al*.[8] self-management of INR resulted in a degree of anticoagulation control that was equivalent to that obtained with management by the Thrombosis Service. In the studies by Watzke *et al*.[10] and Sawicki *et al.*[9], weekly self-testing and dosing resulted in better control of anticoagulation than that obtained with conventional care by specialized clinic and family physicians, respectively. In these three randomized studies a structured teaching program was implemented based on the use of either phenprocoumon or acenocoumarol.

In order to implement a structured teaching program in our clinics, we set out to examine the ability of selected patients on chronic OAT to self-adjust their dose without specific training. We also aimed to establish the feasibility of integrating the use of home PT monitoring with the routine surveillance activity of the anticoagulation clinic in selected patients.

Our data indicate that patients on chronic OAT therapy can acquire the ability to self-adjust their dose without specific training in self-adjustment.

We analyzed the relation between the ability of patients to suggest a dose adjustment in relation to their mean weekly dosage, as prescribed by the Center. When the agreement was expressed as a percentage difference, the concordance within ± 6% increased significantly with increasing mean weekly dose among both warfarin and acenocoumarol users. These findings indicate that dose self-adjustment might be more difficult for those patients more sensitive to warfarin or acenocoumarol and requiring a low weekly dose. Thus information about individual sensitivity to warfarin should be incorporated in a structured teaching program for self-monitoring and self-adjustment. This also implies that in the initial phase of oral anticoagulant therapy patients on self-adjustment should be advised that very careful monitoring and adjustment are required, because the information about individual sensitivity might not be completely available.

The results of this study should be interpreted in the light of several sources of potential bias. The lack of randomization of patients introduces selection bias. However patients were chosen randomly from the electronic database of the centers and then asked to participate in the study. We studied only patients who had been on OAT therapy for an average of 5.5 years. They were also selected on the basis of the results of information-memory testing and because of their regular attendance at the anticoagulation clinic and their high level of compliance. During the instruction phase of the study, they received instructions only on self-testing and no guidelines were given for self-adjustment. Thus their ability to suggest a weekly dose and the date for next PT control during the study may reflect: 1) the degree of theoretical knowledge on OAT therapy acquired at the education sessions given by anticoagulation clinics to all patients, and 2) the degree of practical knowledge acquired during the several years of duration of their therapy.

To minimize the possibility that patients would measure their PT at home more frequently than recommended by the anticoagulation clinic, the patients were supplied with monitor cartridges which were not on sale to the public. Thus it was necessary for them to refer to the anticoagulation clinic to obtain any further supply of cartridges.

Another source of potential bias is that some patients did not follow the prescription by the Clinic but decided to follow their self-adjusted dose. This is a possibility that cannot be excluded. However, this group of very well trained and selected patients was able to suggest a weekly dose which was concordant or differed by ± 2.5 mg for warfarin and by ± 1 mg for acenocoumarol in 86% and 90.8% of suggestions,

respectively.

Although 27% patients declared themselves confident about self-adjusting their OAT dose, the majority expressed the preference for self-testing with dose adjustment done by the Clinic. The patients' attitudes in this study are quite different from those reported in other studies. This difference might be due to the fact that patients were used to being under the surveillance of an Anticoagulation Clinic and that they were not specifically instructed to self-adjust their dose. As a result, they may have felt more confident in being managed by the Anticoagulation Clinic.

Home self-testing and self-management have important implications. Frequent testing at home may lead to better anticoagulation control and a reduction of the frequency of complications.

Therapeutic self-management should minimize patient inconvenience and enhance patient compliance. Thus further studies are needed to assess the possibility of patient self-management.

Contributions and Acknowledgments

BC co-ordinated the study, performed the collection and analysis of data and wrote the paper; GP designed the study, had the main responsibility for the study and revised the manuscript; MM,VP, ST co-ordinated the study in each center and revised the manuscript; MC, AB, GM and PR were responsible for the collection of data locally. The contribution of the clinicians and nurses in each center is gratefully acknowledged.

Funding

This study was supported by Roche Diagnostics, Milan, Italy.

Disclosures

Conflict of interest: none.

Redundant publication: no substantial overlapping with previous papers.

Manuscript processing

Manuscript received April 7, 2000; accepted June 19, 2000.

Potential implications for clinical practice

- Our data indicate that selected patients on chronic oral anticoagulant therapy can acquire the ability to self-adjust their OAT dose without specific training. Our data confirm that Coagucheck can be integrated into the routine activity of an anticoagulation clinic for the surveillance of chronic anticoagulant therapy in selected patients after training in self-testing.

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