Quality in Practice

Management of suspected venous thromboembolism: the impact of a multifaceted intervention

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Abstract

Objective. To achieve a common strategy in the event of a suspected venous thromboembolism.

Design. A multifaceted intervention, combining an audit strategy and implementation of local guidelines: phase 1, the first step, consisted of a 6-month audit to identify dysfunction; during phase 2, intervention, local guidelines were formulated by a working group and then implemented; phase 3 consisted of a re-audit over a 6-month period following the intervention.

Setting. A tertiary hospital, France.

Participants. 419 patients with suspected venous thromboembolism in phase 1; 287 patients with suspected pulmonary embolism in phase 3.

Results. First phase: a dysfunction was observed in three of five criteria under study: (i) the diagnostic procedure lasted more than 48 hours in 114 patients (27.2%); (ii) no anticoagulant therapy at the time of suspicion in 116 patients (27.7%); (iii) an inconclusive lung scan without further testing in the event of a suspected pulmonary embolism in 40 patients (14%); the intervention phase was thus restricted to the management of suspected pulmonary embolism; similar results were found during the phase 3 re-audit.

Conclusion. No improvement in the diagnostic work-up in the event of a suspected pulmonary embolism was observed following this multifaceted intervention.

Keywords: audit, deep vein thrombosis, multifaceted intervention, pulmonary embolism

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Among the frequent and potentially life threatening diseases routinely managed in our hospital [1], venous thromboembolism (VTE) is recognized as a clinical problem for at least three reasons which may also be encountered in other centres; firstly, the clinical suspicion of VTE is raised by different physicians in different settings: emergency wards, intensive care units and/or medical departments; secondly, several procedures, mostly non-invasive, have recently been developed [2,3] and are available in units which are not usually interconnected, including hematology, radiology, nuclear medicine, and ultrasound medicine units; thirdly, participating in prospective multicentre studies and evaluating new diagnostic strategies may interfere with available guidelines for those ineligible/excluded patients, even though this offers the opportunity to perform a rigorous follow-up. Case reports of dysfunction in the diagnostic work-up in the event of a suspected VTE from local opinion leaders prompted this quality assurance programme.

The aim of this intervention was to achieve a common strategy when facing suspected VTE. Therefore, we designed this tertiary hospital-based programme as a multifaceted intervention, combining an audit strategy and the implementation of local guidelines: phase 1 consisted of a 6-month audit to identify dysfunction; during phase 2, intervention, local guidelines were formulated by a working group and then implemented; phase 3 consisted of a re-audit over a 6-month period following the intervention.
Phase I: audit

Identification of problems and setting standards

The initial stage included a preliminary meeting: on behalf of the Groupe d’études de la Thrombose de Bretagne Occidentale (GETBO), all physicians working in hospital departments/units and dealing with clinically suspected VTE patients (including emergency units and laboratories) were invited to take part in a working group. As stated in a covering letter, the aim of this meeting was “the improvement of local practice in the field of VTE management”. Local opinion leaders as well as other physicians were invited. For this intervention, a facilitator was recruited from the Department of Public Health; this physician, who was not involved in the daily care of suspected VTE patients, acted as a guide during the whole implementation period of the intervention. During this first meeting, the feasibility of putting into practice such a quality assurance programme supported by the Ministry of Health was discussed; problems were then listed and all participants took part in a brainstorming session. A request to submit all relevant research papers and consensus statements was made by the facilitator to all the participants: the collected material was then mailed to the working group. The aim of the second session held a month later was to select those indicators of dysfunction considered as relevant; a consensus was reached at that time to define five indicators, as shown in Table 1.

Setting

A first request to the hospital registry (looking for ICD-9CM codes ‘pulmonary embolism’ and ‘deep vein thrombosis’) showed that more than 90% of all diagnosed VTE patients had stayed in one of the following units: cardiology (60 beds), intensive care medicine (12 beds), internal medicine (3 units—117 beds), chest diseases (43 beds). The audit was thus restricted to these units, plus the emergency department (suspected VTE managed on an outpatient basis).

Table 1 Five criteria of dysfunction in the event of a suspected VTE, as selected by the working group

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<tr>
<td>1</td>
<td>A diagnostic procedure lasting more than 48 hours.</td>
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<td>2</td>
<td>No prescription of anticoagulants at the time of suspicion and during the following 8 hours.</td>
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<td>3</td>
<td>Inadequate use of D-Dimer testing (use of latex D-Dimer—withdrawal of anticoagulants in the case of a negative D-Dimer in the event of a suspected DVT).</td>
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<td>4</td>
<td>An inconclusive lung scan without further testing if PE is suspected.</td>
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<td>5</td>
<td>Inconclusive Doppler venous ultrasonography without further testing if DVT is suspected.</td>
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Identification of suspected VTE patients

The Department of Internal Medicine and Chest Diseases was the only one to keep a register of all suspected VTE patients. Patient identification thus needed cross requests from: (i) the files of the Emergency Department (suspected VTE diagnosis when entering the hospital); (ii) the files of the Hematology Laboratory (plasma D-Dimer testing), the radiology unit (helical computed tomography), the Nuclear Medicine Unit (lung scan) and the Doppler Ultrasound Unit (ultrasonography of the legs); (iii) the Pharmacy register (anticoagulation prescription).

Data collection

This audit took place between 13 January and 13 July 1997. Data were individually extracted from each patient file, verified, and entered into the EPI-INFO version 6 software.

Results

We identified 419 patients with a clinical suspicion of VTE. Among them, 286 patients presented a clinical suspicion of pulmonary embolism (PE) and 133 a clinical suspicion of deep vein thrombosis (DVT). Mean age was 65.3 ±17.6 years (range 17–95); there were 194 men and 225 women. Patient localization was as follows: 205 patients in the Internal Medicine Units, 118 in the Chest Diseases Unit, 43 in the Cardiology Unit (including 18 in intensive care), 11 in the Medical Intensive Care Unit, and 42 in the Emergency Unit. VTE diagnosis was confirmed in 148 patients (35.3%): there were 106 PE cases and 42 isolated DVT cases; diagnosis was excluded in the other 271 patients (64.6%). Eighteen patients died during the hospital stay.

As shown in Table 2, following the clinical suspicion of VTE in these 419 patients, 634 specific complementary examinations were performed (apart from a quasi-systematic D-Dimer testing). Among the 252 lung scans performed, 40 (15.8%) were classified as high probability (15.8%) and 31 (12.3%) as normal. The remaining 181 (72%) lung scans were classified as inconclusive. Among the 342 lower limb venous compression ultrasonography examinations performed, 124 (36.2%) showed no abnormalities, whereas 121 (35.3%) were classified as positive for DVT. The 97 (28.4%) remaining tests were classified as inconclusive. Nine of the 32 helical computed tomography tests performed were diagnosed as PE. Finally, three venographies (two positive for DVT) and five pulmonary angiographies (all negative for PE) were performed.

The dysfunctions observed were as follows (Table 3). The diagnostic procedure lasted more than 48 hours in 114 patients (91 suspected PE and 23 suspected DVT). Eighty-nine per cent of lung scans (224 of 252) and 67% of venous compression ultrasonographies (225 of 336) were performed within 48 hours following the request.

The percentage of suspected VTE patients who had not been prescribed anticoagulation therapy at the time of suspicion and during the following 8 hours was 27.7 (116 of 419).
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There were 57 suspected DVT cases and 59 suspected PE cases. On analysing the patient files, a major contraindication was detected in only two patients.

A diagnosis based only on latex D-Dimer testing was observed in three cases. All other D-Dimer testings were performed using an ELISA technique.

Among the 181 lung scans which were classified as inconclusive with respect to suspected PE, 40 were not followed up by further testing.

Among the 97 inconclusive venous compression ultrasonographies, 14 were not followed up by further testing (10 suspected PE cases and four suspected DVT cases).

### Phase 2: implementing change

The results of the phase 1 audit were submitted to the working group during the first session of this phase; both participants and physicians unable to attend the meeting were mailed a summary of the initial findings. At the end of this session, the working group reached the conclusion that no major dysfunction had been observed in the diagnostic work-up in the event of a suspected DVT: a consensus was reached to focus on the diagnostic work-up in the event of a suspected PE. Each participant was then invited by the facilitator to suggest a diagnostic algorithm, following two main instructions: (i) to look
for grade A evidence and provide published studies supporting their proposal; (ii) to encourage feedback from their team, regarding scientific content, general presentation, and feasibility. Two 2-hour meetings were held over a 2-month period with a high attendance rate (only one physician from an emergency ward was not available for the first session and only one physician from an internal medicine unit was not available for the second session). A draft of the diagnostic algorithm was generated at that time and finally discussed during a fourth meeting. No assessment of the pre-test clinical probability of PE was included in the draft of the diagnostic algorithm for two main reasons: firstly, most participants felt unfamiliar with such a clinical practice; secondly, the priority was to improve the adequacy of prescribing objective tests. The final version of the algorithm was formatted in an A6 plastered reminder that included opening hours, phone numbers, and emergency procedures (Figure 1).

This diagnostic algorithm was then distributed in three ways: (i) mailed to all physicians in the hospital, with an explanatory covering letter; (ii) included on the hospital website; (iii) presented in local meetings held by members of the working group in each unit/department involved in the diagnosis of PE; in addition, two meetings were held for the benefit of residents. This implementation phase lasted 3 months.

To facilitate the implementation of the diagnostic algorithm, new forms concerning the requests and/or the results from venous compression ultrasonography of the lower limbs and from lung scan were produced. In the case of a negative or inconclusive venous compression ultrasonography test, a comment mentioning the interest of further explorations was made. In the event of an inconclusive lung scan, a comment explaining the significance of a weak or intermediate lung scan probability was included on the result form. In addition, particular attention was paid to ensure a Saturday morning routine open access for both lung scan and venous Doppler ultrasound imaging examinations.

**Figure 1** diagnostic algorithm. PE: pulmonary embolism; DVT: deep vein thrombosis; *In the case of a major contraindication, the diagnosis has to be processed within an hour. **Front-line examination depends on the availability: replace by lung scan or helical computed tomography if necessary. ***In the absence of DVT detected by compression ultrasonography.

**Phase 3: re-audit**

This last step involved a six-month evaluation of the impact of these recommendations. This audit took place between 1 July and 1 December 2000. The identification of suspected PE cases followed the same pathway as in Phase 1.

We identified 287 patients with a clinical suspicion of PE. Mean age was 69.5 ± 17.6 years (range 19–96); there were 126 men and 161 women. Pulmonary embolism diagnosis was confirmed in 91 patients (31.7%). Patient localization was as follows: 151 patients in Internal Medicine Units, 72 in the Chest Diseases Unit, 53 in the Cardiology Unit (including 22 in intensive care), five in the Medical Intensive Care Unit, and six in the Emergency Unit. Following the clinical suspicion of PE in these 287 patients, 482 specific complementary examinations were performed and the results are detailed in Table 2. A low proportion (3.8%) of inconclusive lower limb compression ultrasonography tests was observed during this phase 3; this might be linked to the improvement in team skills in charge of these examinations over time and/or to technical improvements with the new generation of colour duplex ultrasounds.

The dysfunctions observed were as follows (Table 3). The diagnostic work-up lasted more than 48 hours in 84 patients (29.3%); 28.2% of the patients (81 of 287) did not receive anticoagulant therapy at the time of clinical suspicion or during the following 8 hours. An analysis of patient files revealed a major contraindication in six of them.

Among the 76/129 lung scans classified as inconclusive, 44 (15.3%) were not followed up by further testing.

**Discussion**

This study failed to detect any improvement in the diagnostic work-up in the event of a suspected PE, following the implementation of our local guidelines. The passive circulation of information is generally ineffective in altering professional practice, no matter how important the issue [4]; therefore, we used a multifaceted intervention design, with a view to achieving a higher effectiveness than in the case of a single intervention study design. Several tools were used, including audit and feedback, local consensus process, circulation of a reminder, and re-audit [4,5].

At least three pitfalls may explain these negative results: (i) an inappropriate choice of dysfunction criteria; (ii) an unadapted diagnostic algorithm; and (iii) the failure of the intervention to break down physician barriers with a view to change. The first two pitfalls are closely related to the study protocol. The dysfunction criteria were identified at the end of two
working sessions; particular care was taken to select indicators that could be reliably measured, taking into account a retrospective data collection design. The main motivation behind this choice of simple and reliable indicators was based on the self-review process used in this audit; alternatively, an external review process might have offered the opportunity to make a more qualitative assessment (e.g. file reviews of the diagnostic process by a panel of independent experts, with a classification of the diagnostic process considered as appropriate or not).

The implementation of an unadapted diagnostic algorithm might be the origin of the second pitfall. As underlined by Summerskill [6], guidelines are more likely to succeed when they: (i) involve users in formulating them; (ii) are based on evidence medicine; (iii) complement current medical practice; (iv) are clearly presented; and (v) are implemented actively. The process of the second phase (implementing change) was conducted according to these recommendations. The diagnostic algorithm did not take into account the pre-test clinical probability of PE, as most of the working group members felt that its inclusion could lead to a more complex algorithm [6,7]. At the time of the generation of the diagnosis algorithm draft, most participants of the working group were unfamiliar with such a practice, and few of them included an assessment of the pre-test clinical probability, with or without the use of standardized scores; the hypothesis that more clinicians included clinical probability in their routine decision process during the third part of the study, as the amount of published data on this topic increased, cannot be ruled out. Thus, the diagnostic algorithm may have been perceived as being too inflexible for individual clinical judgement. This may explain why no improvement was observed as regards the criterion ‘inconclusive lung scan without further testing’; the lack of improvement observed as regards the other two criteria (‘diagnosis process lasting more than 48 hours’ and ‘no prescription for anticoagulants’) is more difficult to explain and it does illustrate the failure of the intervention to break down physician barriers with a view to change. Our study was not designed to assess the influence of physician characteristics, experience, and attitudes concerning clinical decision-making in the event of a suspected PE [8]; during the first and second audits, no data on the unit or the physicians in charge of the patient were collected. This option of blinding the data regarding such information was initially adopted in order to facilitate the global process of improving professional practice. However, it does seem that the implementation of change involving mainly senior practitioners failed to alter the residents’ decision-making procedures: in our tertiary hospital, many residents are involved in making front-line day-to-day bedside decisions. For these residents, implementation of change might have been perceived simply as a passive circulation of information. To test this hypothesis, further interventions should involve both residents and their teachers from the undergraduate medical educational programme team.

In this case, recent developments in cognitive psychology, expertise development, and professional training suggest that, in order for new information to be available and functional as regards any future decision-making process, it must be integrated into the individual semantic network [9]. Thus, the transfer of knowledge involves a highly complex process; in order to reach this goal, educational interventions must highlight and focus on the idiosyncratic background knowledge of each learner. As regards these educational strategies, even though phase 2 included an interactive didactic meeting format, it seems to have failed to set up optimal conditions. Moreover, from the point of view of reflective practitioners, whether they are residents or senior practitioners, this background knowledge includes cognitive representations of health problems which are based upon problem solving and decision-making strategies previously used with other patients [10]. As these strategies are most often heuristic rather than algorithmic, the presentation of our guidelines might have been perceived as cognitively non-viable knowledge [11].

Several audits on the diagnostic approach, the prevention and treatment of PE have already underlined the discrepancies between current recommendations and practice [12–15]. Saro and co-workers [14] recently reviewed the files of 251 suspected PE cases from a tertiary hospital: among patients who were diagnosed as having PE and receiving anticoagulant therapy, 32% did not have the diagnosis confirmed by an imaging technique and most of them had a non-diagnostic lung scan. To our knowledge, more complex, multifaceted interventions have not been published in this field [16]. Finally, it is difficult to know whether or not the medical educational programmes regarding the diagnosis of PE, based on the viewpoint of reflective practitioners as underlined above, could potentially alter practice. Whatever, the whole issue deserves further exploration.

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References


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