

Management of patients with polycythaemia vera: results of a survey among Swedish haematologists

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Abstract: The prevailing attitudes regarding diagnostic and therapeutic procedures in patients with polycythaemia vera (PV) among Swedish haematologists were surveyed by way of a mailed questionnaire in August 2002. Among diagnostic procedures frequent use is reported for arterial O₂ saturation, spleen size determination, bone marrow histology, serum erythropoietin, serum cobalamins and leukocyte alkaline phosphatase score, while direct determination of the red blood cell mass is used infrequently (seldom or never by 82%). Among therapeutic modalities hydroxyurea and phlebotomy alone were most frequently used. The ³²P therapy was used at least sometimes by 57% of the physicians, and more widely in the university clinics. Anagrelide and alfa-interferon was used in a minority of patients only. The use of prophylactic acetylsalicylic acid was very variable. The majority of the physicians had an aim for their phlebotomy treatment at a level of 0.45 or less, but 21% used a level of 0.46–0.49 and 8% a level of 0.55–0.60 (in younger patients). The platelet level, at which myelosuppressive therapy was initiated, also varied, from 400 × 10⁹/L to > 1500 × 10⁹/L. It can be concluded that in practical clinical work in Sweden the diagnosis of PV is established by frequent use of serum erythropoietin, bone marrow examination and spleen size determination. The use of different therapeutic modalities is very variable. Many physicians carry out their phlebotomy treatment with less intensity compared with national and international recommendations.

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The majority of patients with Philadelphia chromosome negative myeloproliferative diseases (MPD) may – although these disorders are of a neoplastic nature – have a prolonged, relatively benign clinical course, often spanning over 10–20 yr (1). To achieve such an outcome, all aspects of the management of the patients, i.e. diagnostic work-up, choice of initial and second-line therapies and management of complications, have to be carefully considered and meticulously attended. However, several areas in the management of patients with polycythaemia vera (PV) and essential thrombocythaemia (ET) are debated and controversial, e.g. the diagnostic criteria, the investigations necessary for establishing a safe diagnosis, the indications for myelosuppressive therapy, how intense a phlebotomy regimen should be and the

optimal choice of platelet-lowering agents. In large parts of the world the original Polycythemia Vera Study Group (PVSG) criteria (2) for the diagnosis of PV are still in use, in spite of the fact that they are at least in part obsolete. Other sets of criteria have been suggested, but not generally accepted (3, 4). The original controversy, addressed by the PVSG, i.e. the value of phlebotomy alone vs. different forms of myelosuppression as long-term therapy in PV, is still unsolved, at least with regard to optimal myelosuppressive treatment.

The Swedish MPD Study Group was established in 1994 and issued in 1998 National Guidelines to assist in the diagnosis and treatment of patients with MPD (5). These were distributed among Swedish haematologists and internists at all hospitals caring for MPD patients. At that time the

impression within the group was that the management of patients with PV, both with regard to diagnosis and therapy, significantly differed due to local traditions. The Guidelines did not offer any new sets of diagnostic criteria, but documented the existing ones, and aimed to describe a sensible way of using the available diagnostic tools. Since it was well known to the group that many hospitals lacked resources for adequate blood volume determination, the Guidelines recommended that this examination should have its main role in questionable cases, where PV otherwise could not be separated from other forms of polycythaemia. Determination of serum erythropoietin (s-EPO) and bone marrow histology on the other hand were recommended as rather simple and valuable examinations in the work-up of a polycythaemic patient. In the same way the available treatment options in PV (phlebotomy alone, ³²P, hydroxyurea, busulfan, anagrelide, alfa-interferon [α -IFN]) were described, with their pros and cons. It was stated that the new drugs anagrelide and α -IFN might be alternatives in younger patients.

Recently two publications have highlighted a substantial variation among physicians in the approach to the diagnosis and therapy of PV patients, one of them from the US (6), one – considering only the diagnostic aspects – from Western Sweden (7). In order to further elucidate the existing situation among Swedish haematologists, 4 yr after issuing the National Guidelines, we undertook in 2002 a survey among all physicians handling MPD patients. The results from this survey constitute the content of this report.

Methods and materials

In August 2002, a questionnaire comprising in total 34 questions was mailed to relevant clinical directors at all Swedish acute care hospitals (i.e. six Departments of Haematology and 77 Departments of Internal Medicine). It was requested that each physician caring for MPD patients should individually fill out one questionnaire. Responses were obtained from 65 clinics (78%), but six of them stated that they did not handle MPD patients. One-hundred and five questionnaires were returned, but two of them had to be discarded because of severe incompleteness, leaving 103 (from 57 clinics) to be included in the studied material. Of these 38 came from 11 university hospitals (37%; median 4; range 1–6), 36 came from 19 large county hospitals (34%; median 2, range 1–4) and 29 from 27 small county hospitals (29%; median 1; range 1–3). Responses from all university hospitals were obtained, while four large and 12 small county hospitals did not respond.

Seventy-three (71%) of the responding physicians characterised themselves as haematologists, 24 (23%) as specialists in internal medicine and 6 (6%) as combined haematologist–internists. The proportion of haematologists among the responders varied between the different hospital types (95% at university clinics, 89% at large and 28% at small county hospitals). The median length of the general clinical experience was 20 yr (32% more than 20 yr, 11% less than 10 yr), and did not significantly differ between hospital types. The median length of time working as a haematologist was 13 yr.

The responding physicians further stated that they, at the time of the questionnaire, cared for a median of 5–9 patients with PV, ET and myelofibrosis, respectively. With regard to PV patients and hospital type 42% of the responders from university clinics, 67% from large and 28% from small county hospitals cared for 10 patients or more. The responders stated that they diagnosed a median of 2–4 new patients with PV each year (21%, 22% and 0% saw five new patients or more at university, large and small county hospitals, respectively).

Results

Diagnostic procedures

The physicians were asked to describe their use of different methods, relevant for the diagnostic work-up of patients with polycythaemia. The answer was given as for what percentage of patients each method was used. For this presentation the answers were grouped in three categories: always or often (80–100% of patients), sometimes (21–79%), and seldom or never (0–20%) (Table 1). For most investigations no significant differences in method

Table 1. Percentage of responding physicians using different laboratory methods for the diagnostic work-up of polycythaemic patients. The answers are grouped in three categories, i.e. always-often (100–80% of patients), sometimes (79–21%) and seldom-never (20–0%)

Method	Always-often	Sometimes	Seldom-never
⁵¹ Cr RBC mass determination	5	9	86
Plasma volume determination	7	6	87
Arterial O ₂ saturation	29	24	47
Spleen size ¹	57	28	15
Bone marrow smears	76	16	8
Aspirated bone marrow histology	38	18	44
Bone marrow biopsy	53	24	23
S-erythropoietin	85	9	6
Cytogenetics	3	25	72
S-cobalamins	46	12	42
LAP score	41	16	43
Blood histamine	6	14	80

LAP, leukocyte alkaline phosphatase; RBC, red blood cell.

¹Spleen size determination with isotope scintigraphy, computerised tomography or ultrasound.

utilisation were observed between respondents from university, large or small county hospitals, but for some the usage pattern varied (Table 2). It was noted that a substantial fraction of responders from small county hospitals reported that they never used some diagnostic methods (RBC mass determination 73%, bone marrow histology 20% and s-EPO 20%).

Blood volume determination: A majority of the responding physicians never (52%) or only rarely (to 1–20% of patients; 34%) used determination of the ⁵¹Cr red blood cell (RBC) mass. Only four responders determined the RBC mass in all patients. The pattern was similar for the use of plasma volume determination. Responders at university and large county hospitals tended to use the ⁵¹Cr method slightly more frequently than physicians at smaller hospitals (Table 2). Among those responders, who at least in some patients carried out determination of the blood volume (*n* = 62), a majority (72%) used the ⁵¹Cr labelling method, while 38% used a calculation of red cell mass, based on plasma volume determination and peripheral blood haematocrit.

The use of ⁵¹Cr RBC mass determination should be seen in the context of the availability of the method at the responder's own hospital. This varied considerably between hospital categories (71% at university, 28% at large and 7% at small county hospitals).

Spleen size determination: An objective evaluation of spleen size (with either isotope scintigraphy, computerised tomography (CT) or ultrasound) was reported to be performed always by 40% or often (in 80–99% of patients) by 17% of the responders. There was no difference between hospital categories. CT and ultrasound were the methods most readily available at all types of hospital (86% and 85%,

respectively), while only 32% of the responders had access to scintigraphy (mainly at university hospitals). Almost all of the responders (90%) reported that they never used the older method of estimating the spleen size from abdominal X-ray films.

Bone marrow examination: Almost half of the responders reported that they always or often performed a histological examination of the bone marrow, either in the form of an iliac crest biopsy or as histological sections of aspirated marrow. Biopsy was slightly more frequently used than aspirated marrow histology. Only two responders never used bone marrow examination. When performing a bone marrow a majority (53%) used a combination of biopsy or aspirated marrow histology and smears. A large majority (77%) of the responders reported that a pathologist, specialised in haematopathology examined bone marrow specimens from their polycythaemic patients. No large differences were noted with regard to hospital type.

The s-EPO determinations were frequently used by the responders, in all patients by 73% and in 80–99% of patients by a further 12%. These high figures were in spite of the fact that only 17% of the responders had the analysis available at their own hospital; 63% sent their specimens to a specialised laboratory with high accuracy also for low values of s-EPO.

Serum cobalamins and the leukocyte alkaline phosphatase (LAP) score were reported to be determined always or often by slightly less than half of the responders, but the fraction that never used these methods in the diagnostic work-up was of similar size. A large fraction of the responders (62%) reported that they at least for some patients included a *cytogenetic examination* in the diagnostic work-up.

When physicians, who at the time of the questionnaire cared for a large volume of polycythaemic patients (defined as 10 or more), were compared to those who cared for 0–9 patients, the former tended to use all of the diagnostic methods investigated more frequently (data not shown).

Table 2. Percentage of responding physicians at university (*n* = 38), large (*n* = 36) and small county hospital (*n* = 29) level using certain laboratory methods for the diagnostic work-up of polycythaemic patients. Categories as in Table 1

Method	Always-often	Sometimes	Seldom-never
⁵¹ Cr RBC mass determination			
University	11	10	79
Large county	0	6	94
Small county	3	10	87
Spleen size			
University	42	34	24
Large county	61	31	8
Small county	72	18	10
Bone marrow biopsy			
University	37	40	23
Large county	67	17	16
Small county	59	14	27
S-erythropoietin			
University	81	11	8
Large county	92	8	0
Small county	59	14	27

Therapeutic preferences

Therapeutic modalities: When asked about how large proportion of the patients with a confirmed diagnosis of PV that was treated with different therapeutic modalities, the answers diverged considerably (Table 3). Hydroxyurea was by far the most frequently employed therapy, in use by everybody and reported by 40% of the physicians to be given to 40% or more of the patients. Phlebotomy alone was the second most frequently used modality, used by 29% of the physicians to 40% or more of the patients. Less frequent use was reported for ³²P, anagrelide, α-IFN and busulfan.

Table 3. Number of responding physicians ($n = 93$) reporting the use of different therapeutic interventions for patients with polycythaemia vera, at the time of the questionnaire

Type of therapeutic intervention	Frequency for which the method in question was reported presently used		
	Low (0–20%)	Medium (21–79%)	High (81–100%)
Phlebotomy alone	24	66	3
³² P	69	24	–
Hydroxyurea	13	78	2
Anagrelide	87	6	–
α -interferon	89	4	–
Busulfan	91	1	–

Each of these modalities was used for either no patients at all or only a small fraction.

Responders from small county hospitals more frequently reported that they at present had no patients on ³²P (51%) than physicians at university and large county hospitals (29%) (Table 4). The same tendency was seen for anagrelide (76% vs. 49%) and α -IFN (70% vs. 42%). The use of busulfan seemed to follow another pattern. If used at all, it was not for more than 1–20% of patients, but the fraction of responders from large county hospitals reporting use of this drug was higher (42%), than in university and small county hospitals (14% and 19%, respectively). On a direct follow-up question 51% of the responders stated that they for PV patients never used busulfan, 26% never anagrelide, 12% never ³²P and 9% never α -IFN. Physicians who cared for a larger volume of PV patients (10 or more) reported a more frequent use of all types of myelosuppressive agents. Especially was this the case for anagrelide and α -IFN (data not shown).

Acetylsalicylic acid (ASA): The responding physicians reported a very variable use of prophylactic administration of ASA in patients with PV. About one fourth (23%) did not use it for any patients, 8% gave it to 1–20% of the patients, 17% to 21–40%, 15% to 41–60%, 15% to 61–80%, 12% to 81–99% and 10% to all patients. No substantial differences were observed with regard to the responder’s hospital type or number of PV patients in their care. If any, there was a tendency for a more frequent use of ASA by responders from small county hospitals (where 34% of responders gave prophylaxis to all patients).

	At least some patients for the moment treated with					
	Phlebotomy alone	Hydroxyurea	³² P	Anagrelide	α -interferon	Busulfan
By physicians at university hospitals	100	100	77	56	50	19
By physicians at large county hospitals	92	97	63	43	53	44
By physicians at small county hospitals	96	85	41	19	26	19

Management of phlebotomies: When asked if treatment in a newly diagnosed PV patient always started with phlebotomies, 81% of the responders answered yes, 19% no. In response to the question ‘What is the target haematocrit level for initial phlebotomies?’ the majority answered 0.45. A further 14% used a lower level (0.40–0.44), while 12% indicated that they used a higher level (0.46–0.52).

In the questionnaire the physicians were furthermore asked ‘With a PV patient treated with phlebotomies alone, at which haematocrit level do you prescribe a new phlebotomy = which haematocrit level is the patient not allowed to exceed?’. They were instructed to give one figure for ‘younger’ patients, and one for ‘elderly’ patients. Also here the majority answered 0.45 (used for younger patients by 60% of responders, for elderly patients by 55%). A further 11% and 9%, respectively, used a lower level (0.42–0.44). On the other hand 21% of the responders used – for younger patients – a level of 0.46–0.49, and 8% a level of 0.55–0.60. For elderly patients 22% of the responders used a level of 0.46–0.49 and 14% a level of 0.55–0.60.

Management of thrombocytosis: The platelet level, at which myelosuppressive treatment was initiated in PV patients, varied considerably among the responding physicians. The responders were asked to give separate figures for younger and elderly patients (Table 5). For younger patients almost half of the responders (47%) used an average threshold of 1000–1199 $\times 10^9/L$ for starting therapy; for elderly patients the proportion of responders, who used this level was slightly lower (40%). However, considerable fractions of responders used much lower levels for initiating cytoreductive therapy: for younger patients 24%, and for elderly patients 37% usually started at a

Table 5. Percentage of responding physicians using different thresholds for starting myelosuppressive therapy in PV patients with thrombocytosis

Platelet level used ($10^9/L$)	For younger patients	For elderly patients
400–599	8	10
600–799	16	27
800–999	24	19
1000–1199	47	40
1200–1499	1	1
≥ 1500	5	3

Table 4. Percentage of responding physicians at university hospitals ($n = 35$), large ($n = 34$) and small county hospitals ($n = 27$), reporting the use of different therapeutic interventions for patients with polycythaemia vera, at the time of the questionnaire

platelet level below $800 \times 10^9/L$. Several of the responders commented that besides the platelet level a number of other factors (previous thrombo-embolic episodes, concomitant drug therapy, stage of the disease) influenced the decision when to start platelet-lowering therapy.

All responding physicians were also asked to state their first-hand choice of platelet-lowering agent. Hydroxyurea was always preferred by 60%, and used as one of several alternative agents by a further 28%. A minority of responders preferred to start treatment with α -IFN, anagrelide, ^{32}P or busulfan. With regard to level or choice of drug for intervention in PV patients with thrombocytosis no significant differences were found between responders from different hospital categories or with different PV patient handling experience.

Discussion

In Sweden patients with MPD are traditionally cared for by haematologists or specialists in internal medicine (with a haematological 'profile') at all types of hospitals, the individual patient usually treated at a local clinic. The present survey saw the participation of a high proportion (69%) of all types of clinics (11 university, 19 large and 27 small county hospitals). Responses were obtained from a total of 103 physicians, about 50% of the active haematologists in Sweden. This should be compared with a response rate of only 16% of US haematologists/oncologists in the study by Streiff *et al.* (6) and participation from 6 of 13 hospitals in the region of Western Sweden as reported by Johansson *et al.* (7).

It is also worth noting that the responding physicians in our survey had considerable clinical experience (median 20 yr), the majority of them working as specialised haematologists for a median time of 13 yr. The median number of PV patients cared for at the time of the questionnaire was 5–9. These findings indicate that Swedish MPD patients, even when they are treated at small local hospitals, generally are in the care of well qualified physicians with good experience in this type of disorders.

Diagnostic evaluation of polycythemic patients

The PVSG criteria (8) for the diagnosis of PV are well known to all Swedish haematologists. However, it is also known that the compliance with this set of criteria in clinical routine has been variable, well demonstrated in the local survey by Johansson *et al.* (7), where only 36% of PV patients fulfilled the formal criteria. Indeed, the use of red cell mass determinations was infrequent outside the university hospitals. In the Guidelines, issued by the Swedish

MPD group in 1998 and distributed to all Swedish hospitals, the available diagnostic tools were discussed. Histological bone marrow examination is traditionally widely used in Sweden to establish the diagnosis of MPD (9), and biopsy from the iliac crest was one of the tools recommended in the Guidelines. Histo-pathological evaluation has recently also been included in the WHO criteria (4). Subnormal s-EPO has been shown to be a valuable marker of PV (10–12), why this diagnostic tool was also recommended in the Guidelines.

The present survey, performed in 2002, illustrates the prevailing attitudes to the diagnosis of polycythaemic patients among Swedish haematologists. These attitudes can be expected to be the sum of long-standing (local) tradition, impressions from national and international educational and scientific meetings, for certain individuals supplemented by more detailed studies, and the advice given in the Guidelines, distributed in 1998. In short, the diagnostic process in PV patients in the surveyed population of physicians can be described as: frequent use of bone marrow histology (evaluated by a specialist in haematopathology), s-EPO (often determined in a specialised laboratory) and spleen size estimation (most frequently by ultrasound or CT), but infrequent use of blood volume studies, especially direct determination of the RBC mass. A reasonable interpretation of these findings is that if s-EPO and bone marrow histology is consistent with PV diagnosis the need for further investigation with RBC mass is not considered necessary. Physicians with a greater experience (seeing >9 new polycythemic patients per year) tended to have a slightly higher use of all relevant diagnostic methods; however even at university hospital level only 11% of the responders used RBC mass determination 'always' or 'often'.

Because of differences in the questionnaires, the use of different diagnostic tools cannot be directly compared between this study and the study of US physicians, reported by Streiff *et al.* (6). However, there seems to be a clear tendency that American physicians more frequently use RBC mass determination (78% in answer to the question 'What diagnostic tests do you use to diagnose PV') than their Swedish colleagues (14% stating 'always, often or sometimes' in answer to the question 'In which proportion of patients do you use the following diagnostic tests'). On the other hand in Sweden there seems to be a more frequent use of bone marrow studies (56% vs. 42% with definitions as above) and spleen size determination (85% vs. 30%). The S-EPO determination is frequently used in both countries (76% in US, 94% in Sweden, same definitions as above). This is a well documented and safe diagnostic tool (10–12), provided that

the method used is designed to measure EPO in the low interval (13). Erythroid colony assays are not used in more than a few percent of patients, neither in US nor in Sweden. The relatively infrequent use of RBC mass determination in Sweden is not likely to be influenced by costs for this method, as bone marrow examination is more expensive and still, by far, more frequently used. The sparse use of RBC determination is more likely influenced by the availability of the method at local hospitals, the ongoing debate of the necessity of this assessment (12, 14), and the recommendations given in the national Guidelines (5).

From the present survey, taken into account the infrequent use of RBC determinations, it can be concluded that the diagnosis of PV is established with the PVSG criteria only in a minority of patients. On the other hand, it seems reasonable to assume that the majority of PV patients are given a reliable working diagnosis since the use of bone marrow histology and s-EPO is common. This approach seems more convenient for the patients and cost-effective for the health care system, as both investigations can be carried out at the local hospital. A reliable PV diagnosis in accordance with the WHO criteria can in many cases be confirmed.

Treatment of polycythaemia vera

The results of the survey indicate that several treatment options for PV patients are in use among Swedish haematologists (phlebotomy alone, ^{32}P , hydroxyurea, α -IFN, anagrelide, busulfan; Table 3). However, two options are clearly used more frequently than the others, i.e. phlebotomy alone and hydroxyurea. Other treatment options were used for a minority of patients only. A tendency towards more frequent use of the 'newer' drugs, i.e. anagrelide and α -IFN, was observed among more experienced and university-based clinicians.

As the questions were formulated in our survey, we cannot verify if drug treatment in the individual patients were initiated in order to control the erythrocytosis or thrombocytosis and/or other complications. It is therefore difficult to compare our results with those obtained by Streiff *et al.* (6) in the US, where this specific question was addressed. However, it seems obvious that hydroxyurea is the drug preferred in both countries. Oral (or sometimes intravenous) ^{32}P treatment is much more frequently used in Sweden. The reason may be the massive and long-standing tradition of this treatment modality especially at some of the university centres. Many physicians (and patients) consider this type of treatment convenient, usually giving long periods of good disease control, especially for the elderly patients.

Its continued use may also have been supported by the Swedish report by Brandt and Anderson (15), presenting a material from Lund University Hospital followed for 20 yr, where the outcome for ^{32}P treated patients was not inferior to results for patients with busulfan and hydroxyurea therapy. From the questionnaire we have no data about to which patients this treatment is preferred; our assumption is that mainly elderly patients are chosen for this therapy. Among the patients ($n = 205$) reported by Brandt and Anderson the median age was 70 yr (15). Our survey further indicates that both α -IFN and anagrelide have been firmly introduced into the therapeutic arsenal, but their use at smaller hospitals and by physicians seeing a small volume of new polycythaemia patients is limited. The use of busulfan on the other hand seems to be decreasing. Considering that the mean age of the unselected Swedish PV patient population is around 70 yr, and that α -IFN should be primarily reserved for younger patients (16), the limited use of this drug by the surveyed physicians may be well in line with the recommendations. The drug cost for the patient is less likely to influence the choice of treatment as the Swedish health care system greatly evens out the differences between various drugs. The familiarity with different treatments and the recommendations given by the national Guidelines (5) are more likely to influence the preference of therapy.

The platelet level leading to the initiation of myelosuppressive therapy also varies considerably among Swedish physicians (Table 5), ranging from $400 \times 10^9/\text{L}$ to $> 1500 \times 10^9/\text{L}$, with a tendency for lower levels in elderly patients. Similar great variations were also noted in the use of ASA prophylaxis, ranging from no use at all (reported by 23% of the responders) to use in all or almost all patients (reported by 22%). This finding should be seen in the light of the lack of reliable studies at the time of the survey. The results of the ECLAP study (17) were published after our study was performed. It can be assumed that this report will lead to a more frequent and uniform use of ASA prophylaxis also in Sweden.

Management of phlebotomies

It is well documented that the target haematocrit for phlebotomy therapy in PV patients should be at least 0.45 (18, 19). In spite of this Streiff *et al.* (6) found that 16% of US physicians in their study used a haematocrit level of 0.50 or higher as target. The proportion of physicians in the present survey using a higher level (0.46–0.52) is similar (14%). When specifically asked the question 'Which haematocrit level is the patient not allowed to exceed?' an even

greater fraction of responders used a higher level (21% a level of 0.46–0.49, and a further 8% a level of 0.55–0.60). For elderly patients the corresponding figures were given as 22% and 14% respectively. It could be concluded that a substantial proportion of Swedish physicians do not carry out the phlebotomy treatment of their PV patients according to international or national recommendations.

Conclusion

In the diagnostic work-up of a polycythaemic patient s-EPO and bone marrow examination are the most frequently used tools among Swedish haematologists, while the use of RBC mass determination is sparse. We are convinced that the diagnosis of the PV patients is accurately done in the majority of patients (12, 14, 20). However, some patients with idiopathic absolute erythrocytosis might be misjudged as apparent polycythaemia with this approach. The study has shown that the PVSG criteria are infrequently used, while alternative approaches to PV diagnosis are common in normal practical clinical work in Sweden. The recommendations in the national Guidelines and the ongoing international debate are probably the most important causes of this shift in diagnostic procedure. With regard to the therapeutic management the practice among Swedish haematologists considerably diverges from what is considered as optimal management (16, 18, 19). The most marked deviations are the rather high proportion of patients receiving ³²P as myelosuppressive therapy, and the fact that a substantial fraction of physicians uses a too high haematocrit target level for their phlebotomy regimen. Updating, elucidation and broadly distributing the Guidelines, originally published in 1998 (5), is presumably the most efficient way of supporting clinicians with responsibility for the diagnosis and treatment of MPD patients. The heterogeneity in treatment of patients with PV among Swedish haematologists might reflect the lack of large and reliable studies. Further international co-operation is necessary in order to bring answers to the many questions regarding optimal management of PV patients.

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