SN Comprehensive Clinical Medicine (2022) 4:48
https://doi.org/10.1007/s42399-022-01130-3

REVIEW

Clinical features of POEMS syndrome in Southeast Asia: a literature-based study

Mario B. Prado Jr[1,2] · Karen Joy Adiao[2]

Accepted: 18 January 2022 / Published online: 31 January 2022
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2022

Abstract

To determine and analyze the clinical characteristics of POEMS syndrome among Southeast Asian countries. We searched the literature using a pre-specified inclusion and exclusion criteria and using the search terms "[(POEMS) or (Takatsuki) or (PEP) or (Crow Fukase) and (syndrome)] AND [Countries/People of Southeast Asia]". Seven studies, including 5 case reports, 1 case series, and 1 correspondence letter containing 8 patients, were eligible for analysis. The median age of onset was 54 years, while the median duration to correct diagnosis was 5.5 months. The most common initial presentation was weakness (4/6) with 50% initially diagnosed as chronic inflammatory demyelinating polyneuropathy. On physical examination, 100% had evidence of length dependent polyneuropathy, 80% had papilledema, 75% had edema/effusion, 86% had skin changes, and 67% had organomegaly. All had abnormal NCS and CT scan while 1 tested negative for monoclonal gammopathy restricted to lambda. Only 2 had VEGF results, one of which was normal. Melphalan and steroid combination was the most common treatment given with only 1 case dying of sepsis. Although the number of cases in Southeast Asia is lower, which can be attributed to difference in ethnicity and geographical location, the presenting signs and symptoms of this condition were similar to other countries. However, the new proposed criteria may not be applicable in the region as only few countries are capable of VEGF testing.

Keywords POEMS syndrome · Southeast Asia · Crow Fukase syndrome · Prevalence · Clinical features

Abbreviations

POEMS	Polyneuropathy, organomegaly, endocrinopathy, M-protein, skin changes
SEA	Southeast Asia
VEGF	Vascular endothelial growth factor
PEP	Plasma cell dyscrasia, endocrinopathy, polyneuropathy
CIDP	Chronic inflammatory demyelinating polyneuropathy
XDP	X-linked dystonia parkinsonism

This article is part of the Topical Collection on *Medicine*

✉ Mario B. Prado Jr
mbprado@alum.up.edu.ph

[1] Department of Epidemiology and Biostatistics, College of Public Health, University of the Philippines, Manila, Philippines

[2] Section of Neurology, Department of the Neurosciences, Philippine General Hospital, University of the Philippines, Taft Avenue, Metro Manila, Philippines

Introduction

POEMS syndrome is a rare monoclonal gammopathy characterized predominantly by *p*olyneuropathy, *o*rganomegaly, *e*ndocrinopathy, *M*-protein, and *s*kin changes [1, 2]. Not all conditions represented in the acronym are needed for its diagnosis as other manifestations such as Castleman disease, sclerotic bone lesions, papilledema, effusion or edema, polycythemia, erythrocytosis, or thrombocytosis, mostly thought to be secondary to elevated vascular endothelial growth factor (VEGF) levels, may be required to satisfy the criteria for diagnosis [3]. Despite the availability of several criteria, diagnosing POEMS syndrome is a challenge since it affects multiple organs [1, 4, 5]. Around 60% will initially present with polyneuropathy, with the same proportion being mislabeled as chronic inflammatory demyelinating polyneuropathy (CIDP) at first encounter [6–9]. Early and correct diagnosis is of utmost importance as prognosis is poor [3]. In a retrospective study conducted in Japan in the 1980s, 66% of 58 patients died, with mean survival time of 33 months [5]. In recent years, due to increased awareness and improvement in the battery of management options such as radiotherapy,

autologous stem cell therapy with high-dose chemotherapy, use of immunomodulators, and protease inhibitors, long-term survival has drastically improved [3, 4, 10].

Despite its rarity, POEMS syndrome is relatively more common in East Asian than Southeast Asian (SEA) Countries. A national survey in Japan in 2019 revealed a prevalence of 0.3/100,000 [11]. A recent literature review of all cases published in China identified a total of 1946 cases from 1986 to 2016 [7]. In the USA [1] and India [12], the true prevalence is still unknown. No case series of more than five patients were published in any of the 11 countries in Southeast Asia to date.

Therefore, the main objective of this study is to search for published cases of POEMS syndrome in the 11 countries in Southeast Asia, namely, Singapore, the Philippines, Malaysia, Indonesia, Thailand, Brunei, Vietnam, Cambodia, Laos, Myanmar, and Papua New Guinea, and determine and analyze its clinical characteristics among Southeast Asian people.

Materials and Methods

Search Process

Two review authors (MBP and KJA), both neurologists, conducted the search and selected the reports. Whenever a disagreement was present, a third-party consultant (KP) made the decision. The following search terms were used in PubMed Medline, Cochrane, and Embase:

1. (POEMS OR TAKATSUKI OR CROW-FUKASE OR PEP) AND (Syndrome)
2. Malay (Including all population in Southeast Asia)
3. #1 AND #2

The search strategy terms were formulated last December 2020 and approved by authors. No additional filters were included. Additional journals from references whenever applicable were also reviewed. Titles and abstracts of the initial results were screened for duplication and relevance. Full articles of the unrejected studies were collected and reviewed. Authors of studies were sent electronic mails to gather more information if needed. Ongoing and unpublished data sources were also searched whenever possible by using RIAT. Articles that satisfied the eligibility criteria were included in the analysis.

Eligibility Criteria

Only studies involving people of Malay descent were included. Specifically, studies involving Singaporeans, Malaysians, Filipinos, Thais, Cambodians, Indonesians, Vietnamese, Lao and people from Myanmar and Papua New Guinea were analyzed. Cases should have satisfied POEMS syndrome criteria by Dispenzieri [1], Kuwabara [5], or Suichi [5] whenever possible.

As studies about POEMS syndrome in SEA were expected to be sparse, case reports, case series, case controls, retrospective, and prospective cohorts and non-randomized trials were included. Published peer reviewed journals were given priority although unpublished, partially published and studies published in "gray" literatures were also considered to decrease publication bias. English-written journals and English-translated journals were prioritized. Since correspondence letters are similar to case reports, they were included.

Data Collection

Both review authors independently obtained data from eligible studies using a pre-conceptualized data collection form. Information collated include country where the journal was published, year, author, type of publication, nationality of the patient, age, sex, chief complaint, reason for initial consult, duration of the disease, initial diagnosis, and the presence of classic signs and symptoms of POEMS syndrome. Laboratory and diagnostic examinations such as NCS, serum immunofixation, serum electrophoresis, bone marrow biopsy, CSF analysis, abdominal or chest CT scan, lymph node biopsy, ultrasound, full blood count, liver, and renal function tests and endocrinopathy panels were also extracted. Likewise, the treatment strategy and outcomes were also extracted. In addition, the journals were assessed if they satisfied the mandatory, major, and minor criteria set by Dispenzieri [1].

Due to the heterogeneity and lack of consensus for the application of risk assessment tools for observational studies, assessment of bias was not done. Nevertheless, observational studies were considered as biased and subject to the effect of confounders. Data were analyzed using Microsoft excel.

Results

Result of the Search

In total, 46 articles were obtained from PubMed and Medline with no records extracted from searching through references. After removing duplicates, the abstracts and titles of 24 articles were reviewed for relevance. Only 13 articles were assessed for eligibility. Of these, 6 were excluded because either the full articles were unobtainable or they did not meet the inclusion criteria (Tables 1 and 2). Authors were sent electronic mails to request for the full articles to

Table 1 Summary of included studies

Country	Year	Author	Nationality	Age	Sex	Time to diagnosis	Polyneuropathy	Monoclonal gammopathy	Bone lesions	Elevated VEGF	Castleman disease	Skin changes	Organomegaly	Polycythemia/erythrocytosis/thrombocytosis/	Effusion	Papilledema
Indonesia	2010	Oehadian	Indonesian	50	F	2	Yes	Yes	No	No mention	No	Yes	Yes	No	Yes	Yes
Malaysia	2019	Low	Malaysian	32	M	5	Yes	Yes	Yes	No mention	No	Yes	Yes	Yes	Yes	No
Malaysia	2017	Nyunt	Malaysian	65	F	4	Yes	Yes	Yes	No mention	No	Yes	Yes	Yes	No	No mention
Thailand	2018	Jindahra	Thai	52	M	24	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Malaysia	2020	Lau	Malaysian	58	F	No mention	Yes	Yes	Yes	No mention	No	No	Yes	No	Yes	Yes
Malaysia	2020	Lau	Malaysian	36	M	No mention	Yes	Yes	Yes	No mention	No	Yes	No	Yes	No	Yes
Singapore	2020	Chen	Singaporean	81	F	24	Yes	No	No	No	No	Yes	No	No	Yes	No
Singapore	2007	Rathakrishnan	Singaporean	56	M	6	Yes	Yes	Yes	No mention	No	No mention	No	No	Yes	No mention

Table 2 Table of excluded studies

Author	Year	Country	Reason for exclusion
Kamil [13]	2019	Malaysia	Review article
Kasinathan [14]	2020	Malaysia	Chinese patient
Intragumtornchai	1993	Thailand	No full article
Limvorapitak	2017	Thailand	British patient
Witoonpanich	2005	Thailand	No full article
Witoonpanich	1988	Thailand	No full article

no avail. Only 7 case reports, correspondence and case series were deemed eligible for qualitative synthesis (Fig. 1).

Excluded Articles

Of the 13 articles deemed for analysis, 6 were excluded: 1 review article and 5 case reports. Of the 5 case reports, 2 were not included because they discussed cases of British and Chinese nationalities, and 3 had no published full-length articles.

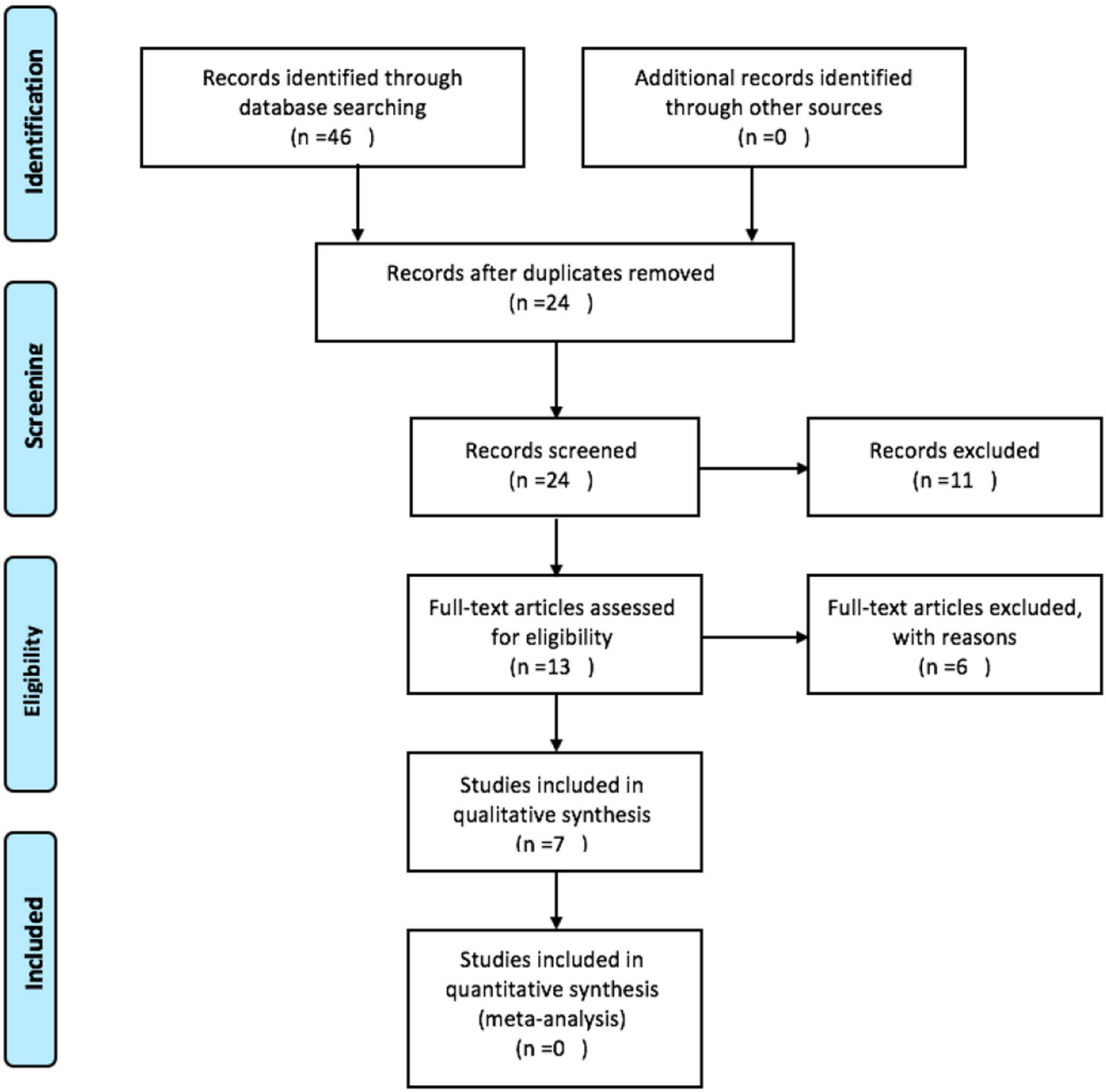

Fig. 1 The PRISMA flow diagram

Characteristics of Included Studies

The seven studies spanned from 2007–2020 and included case series of 2 Malaysians [15]; case reports of 1 Indonesian [16], 2 Malaysians [17, 18], 1 Thai [19], and 1 Singaporean [20] and a correspondence of 1 Singaporean [21] patient. All were written in English (Table 1).

Clinical Signs and Symptoms

The median age of onset was 54 years (range: 32–81 years) with M/F ratio of 1:1. Ordinally, the most common initial presentation was weakness (4/6), followed by sudden visual loss (1/6) and appearance of hemangioma (1/6). The median time to arriving at POEMS syndrome diagnosis was 5.5 months (range: 2–24 months), with 50% presenting first as CIDP (2/4). Other associated symptoms included ascites (1/5), weight loss (3/5), erectile dysfunction, and loss of libido (1/5).

On physical examination, 67% had organomegaly (4/6). Ordinally, 2 had hepatosplenomegaly, 1 had splenomegaly and lymphadenopathy, and 1 had hepatosplenomegaly and lymphadenopathy. Eighty-six percent (6/7) had evidence of hyperpigmentation, hypertrichosis, hemangioma, acrocyanosis, and skin nodules, while 75% (3/4) had findings of ascites, peripheral edema, and generalized anasarca. Eighty percent (4/5) had papilledema, while all patients had evidence of length dependent polyneuropathy mostly characterized by distal weakness (4/4) and reduced deep tendon reflex (4/4). Other important signs included clubbing (1), cachexia (1), and the presence of steppage gait (1).

Laboratory and Diagnostic Examinations

All patients had abnormal NCS-EMG ($n=8$): 7 demyelinating polyneuropathy with axonal loss and one with pure axonopathy. All but 1 who tested for serum electrophoresis or immunofixation had presence of monoclonal gammopathy restricted to lambda. Only two patients had VEGF results, with only one having elevated level. Only two had abnormal bone marrow biopsy (mean plasma cell %:5.5, $n=6$). One patient underwent a lymph node biopsy, which turned out to be normal.

Four patients had abnormal CT scan findings ($n=4$): 2 had osteosclerotic lesions, 2 had hepatomegaly, and 1 had ascites and pleural effusion. Elevated hemoglobin (4/5), white blood cell (1/5), and platelets (2/5) were also recorded. Only one presented with abnormal glucose, TSH, and testosterone.

Treatment and Outcomes

Five patients were treated with Melphalan and steroid combination, while 2 were given immunomodulators (1 thalidomide and 1 linalidomide). Only 1 underwent autologous stem cell transplantation and 1 was subjected to radiotherapy. All patients clinically improved except for the one who underwent radiotherapy. He died of sepsis.

Criteria of POEMS Syndrome

While all papers claimed that POEMS syndrome was present in their cases, only 6 patients satisfied the criteria set by Dispenzieri [1] (Table 3). Whereas all 8 patients fulfilled the minor criteria, only seven fulfilled the 2 mandatory criteria and only 6 passed the major criteria. Automatically, if the new proposed criteria by Suichi [5] was utilized, only 1 will have definitive POEMS syndrome since only 1 had elevated VEGF.

Of the mandatory criteria, 1 patient did not have monoclonal gammopathy restricted to lambda. Of the major criteria, only 6 patients had findings of sclerotic bone lesions and 1 with elevated VEGF level. None had Castleman disease. Skin changes were the most common minor criteria (6/7), followed by papilledema (4/6), effusion and edema (5/8), organomegaly (5/8), polycythemia (4/8), and endocrinopathy (3/8). Two mandatory, 1 major, and 1 minor Dispenzieri criteria should be fulfilled to attain definitive POEMS syndrome diagnosis.

Table 3 Proportion of fulfilled POEMS Syndrome Criteria by Dispenzieri

Criteria	No. of patients satisfying the criteria	%
Polyneuropathy[a] ($n=8$)	8	100
Monoclonal gammopathy restricted to IgA or IgG (lambda)[a] ($n=8$)	7	87.5
Sclerotic bone lesions[b] ($n=8$)	6	85.7
Elevated VEGF[b] ($n=2$)	1	50.0
Castleman disease[b]	0	0
Skin changes[c] ($n=7$)	6	85.7
Papilledema[c] ($n=6$)	4	66.7
Effusion and edema[c] ($n=8$)	5	62.5
Organomegaly[c] ($n=8$)	5	62.5
Polycythemia/erythrocytosis Thrombocytosis[c] ($n=8$)	4	50.0
Endocrinopathy[c] ($n=8$)	3	37.5

[a]Mandatory, [b]Major, [c]Minor

Discussion

Compared to China, the USA, and Japan, which reported 1946 [7], 99 [1], and 392 [11] POEMS syndrome cases, respectively, the combined number of published reports in Southeast Asia was markedly low ($n = 7$). Save for Japan however, the true prevalence of the condition is still unknown even in other countries.

There are several factors that may contribute to the disparity in the number of cases between countries. First, the difference in genetic make-up and geographic location are possible reasons [7]. Although there are no studies to support this, conditions such as multiple sclerosis [22] and X-linked dystonia parkinsonism (XDP) [23] are known to be affected by geography and race, respectively. Second, the increased awareness and abundance of diagnostic equipment and specialists in developed countries may also be factors. Currently, there is a move in Japan to include elevated VEGF as one of the mandatory criteria [5]. However, only 2 cases in our report tested for serum VEGF. Including this criterion as mandatory may lead to underestimation of the true number of cases locally. Third, the volume of published research in developed countries may cause publication bias [24]. However, even Singapore only reported two case reports despite being a developed country [20, 21]. In addition, population dense countries in Southeast Asia like Malaysia and the Philippines send samples and patients to Singapore for diagnosis of difficult cases.

Clinical Manifestations

Unlike other countries which reported male predominance, the ratio of male and female cases was equal in our study. The median age of 54 was comparable to that of Japan (54) [11] but higher than the USA (45) [1] and China (46) [7]. Consistent with the Chinese (60.4%) [7] and Japanese cohorts (49%) [11], the most common initial presentation was peripheral neuropathy (66.7%). Of this, 50% will initially be diagnosed as CIDP (2/4), which was lower compared to 60% of both Chinese and Japanese studies. The median duration to correct diagnosis was significantly lower compared to the Japanese study (5.5 months vs 12 months).

All cases had polyneuropathy since it was required in the mandatory criteria for POEMS syndrome by Dispenzieri [10]. Only 66.7% (4/6) had evidence of organomegaly on physical examination, lower compared to that of Chinese (83%) and Japanese cohorts (76.0%) but higher than US POEMS syndrome patients (50%) [1, 7, 11]. Some forms of skin changes were found in 85.7% of our patients, comparable to the Japanese (84%), but higher than the Chinese (77%) and the USA (68%) studies [1, 7, 11]. Nevertheless, hyperpigmentation was the most common abnormality in all the countries. Like Japan (81%) and China (82%), edema and effusion were also prevalent in our study (75%) with peripheral edema as the most common manifestation. Unlike in the USA where papilledema was reported in only 29%, 4 out of 5 of our case reports (80%) had this minor criterion.

Laboratory and Diagnostics

Seven out of eight patients (87.5%) had diffused demyelinating polyneuropathy with axonal loss consistent with the findings by Sung et al. and in China (98.8%) [6, 7, 13, 25]. While 29 patients were subjected to VEGF test in China and all cases in the Japanese study, only 1 out of the 2 who had test for VEGF levels was elevated. Using the proposed criteria by Suichi [5], the one with normal VEGF and the 6 who had never done the test would not qualify as definite POEMS syndrome and will less likely be reported in the literature. Hence the new criteria are only applicable to developed countries. In a national survey of POEMS syndrome in Japan conducted in 2019, 84% had elevated VEGF levels [5]; nevertheless, in a validation study of a new criteria for POEMS syndrome, all the patients included showed elevated VEGF [11].

All cases in the USA, 89% and 64% in Japanese and Chinese study, respectively, had monoclonal gammopathy restricted to lambda [1, 7, 11]. In our cohort, 7 out of 8 who had test for monoclonal gammopathy were positive. Most had monoclonal IgG restricted to lambda (6 out of 7) which was higher compared to the USA (49.4%). No Castleman syndrome was reported in our study. POEMS syndrome with Castleman disease was proposed to be removed from the major criteria of Dispenzieri by Misawa et al. as this entity had different prognoses compared to the typical POEMS syndrome [3].

Although lower, the proportion of patients with sclerotic or mixed sclerotic-lytic bone lesions was comparable to US cohort (87.5% vs 97%) [1]. Of these, only 50% were detected using CT scan, while the rest were seen using other means. Other findings in the CT scan include organomegaly (2 cases) and effusion (1 case).

Around 73% and 67% from the Chinese and US cohorts, respectively, had endocrinologic abnormality, considerably higher than our 37.5% proportion. Almost 50% of our patients presented with polycythemia, erythrocytosis, and thrombocytosis, slightly higher than the Japanese study (38%).

Treatment Options and Outcomes

Most cases used combination of melphalan and steroid for treatment (5 out of 8). In contrast, Japanese treat their patients mostly with thalidomide (54%) and autologous stem cell transplantation (44%) [11, 26]. Most reports in China used steroids to treat their cases (39.4%) probably because studies were done prior to the development of current treatment and management [7]. In the USA, management depends on the number of sclerotic lesions [1]. Only one died of the case reported died while the rest improved clinically. While the prognosis of POEMS syndrome was poor pre-high dose chemotherapy and immunomodulator era, this has significantly improved over the years [3].

Limitations

The few numbers of cases may be an underestimate of the true prevalence; hence, the study may not be generalizable to the population in Southeast Asia. However, as there are no clinical trials or large observational studies conducted in the region, this study may be the best evidence on the characteristics of the disease in people with Malay descent. The quality of this paper is also dependent on the case reports included. Although the search was comprehensive, we still may have missed some quality papers written in other language considering Southeast Asia consists of countries with diverse cultures and languages. Nevertheless, most Neurology and Hematology societies as well as local journals in Southeast Asia converse and write in English; hence if a paper about POEMS syndrome of good quality is to be published, it will most likely be submitted into an English-based local or international journal. Lastly, some diagnostic work up done to establish the diagnosis of POEMS syndrome are incomplete, unavailable, or reported differently. This will cause differences in interpretation depending on the criteria used (i.e., the use of VEGF).

Conclusions

There were only 8 reported cases of POEMS syndrome in SEA, with most started to have symptoms at 50 s. There was equal sex preponderance with majority having length dependent demyelinating polyneuropathy, monoclonal gammopathy restricted to lambda, papilledema, skin changes, edema, and effusion and organomegaly. Treatment was primarily melphalan and steroid combination. These findings were similar with that of other cohorts in other countries. However due to limitations in the diagnostic tests, recognition, reporting, and differences in the criteria used, the true prevalence of the disease in SEA is yet to be determined.

Funding Dr. Prado receives scholarship grant from Takeda Science Foundation.

Data Availability Not applicable.

Code Availability Not applicable.

Declarations

Ethics Approval Since this is a systematic review, ethics approval was waived.

Consent to Participate Not applicable.

Consent for Publication All authors have read and agreed the contents of the paper (on initial submission and on any revisions or subsequent resubmissions). Likewise, all authors have agreed to submit this paper on SNCM journal.

Conflict of Interest The authors declare no competing interests.

References

1. Dispenzieri A, Kyle RA, Lacy MQ, et al. POEMS syndrome: Definitions and long-term outcome. Blood. 2003;101(7):2496–506. https://doi.org/10.1182/blood-2002-07-2299.
2. Brown R, Ginsberg L. POEMS syndrome: clinical update. J Neurol. 2019;266(1):268–77. https://doi.org/10.1007/s00415-018-9110-6.
3. Misawa S, Kuwabara S. Polyneuropathy, organomegaly, endocrinopathy, monoclonal gammopathy and skin changes (Crow-Fukase) syndrome: Diagnostic criteria and treatment perspectives. Clin Exp Neuroimmunol. 2013;4(3):318–25. https://doi.org/10.1111/cen3.12052.
4. Kuwabara S, Dispenzieri A, Arimura K, Misawa S. Treatment for POEMS (polyneuropathy, organomegaly, endocrinopathy, M-protein, and skin changes) syndrome. Cochrane Database of Syst Rev. 2008;(4). https://doi.org/10.1002/14651858.CD006828.pub2.
5. Suichi T, Misawa S, Sato Y, et al. Proposal of new clinical diagnostic criteria for POEMS syndrome. J Neurol Neurosurg Psychiatry. 2019;90(2):133–7. https://doi.org/10.1136/jnnp-2018-318514.
6. Nasu S, Misawa S, Sekiguchi Y, et al. Different neurological and physiological profiles in POEMS syndrome and chronic inflammatory demyelinating polyneuropathy. J Neurol Neurosurg Psychiatry. 2012;83(5):476–9. https://doi.org/10.1136/jnnp-2011-301706.
7. Wang Y, Huang LB, Shi YH, et al. Characteristics of 1946 cases of POEMS syndrome in Chinese subjects: A literature-based study. Front Immunol. 2019;10(JUN):1–12. https://doi.org/10.3389/fimmu.2019.01428.
8. Prado MB, Narito KM, Adiao KJB. Anti-GM1 IgM antibody positive axonal variant of Guillain-Barre-syndrome in a pediatric patient with dengue fever. J Neuroimmunol. 2021;355:577572. https://doi.org/10.1016/j.jneuroim.2021.577572.
9. Shibuya K, Tsuneyama A, Misawa S, et al. Cranial nerve involvement in typical and atypical chronic inflammatory demyelinating

polyneuropathies. Eur J Neurol. 2020;27(12):2658–61. https://doi.org/10.1111/ene.14497.
10. Dispenzieri A, Buadi FK. A review of POEMS syndrome. Oncology (United States). 2013;27(12):1242–50.
11. Suichi T, Misawa S, Beppu M, et al. Prevalence, clinical profiles, and prognosis of POEMS syndrome in Japanese nationwide survey. Neurology. 2019;93(10):E975–83. https://doi.org/10.1212/WNL.0000000000008062.
12. Soubrier MJ, Dubost JJ, Sauvezie BJM. POEMS syndrome: A study of 25 cases and a review of the literature. Am J Med. 1994;97(6):543–53. https://doi.org/10.1016/0002-9343(94)90350-6.
13. Kamil K, Yazid MD, Idrus RBH, Das S, Kumar J. Peripheral demyelinating diseases: from biology to translational medicine. Front Neurol. 2019;10(March):1–12. https://doi.org/10.3389/fneur.2019.00087.
14. Kasinathan G, Sathar J. Ascites as a presenting sign of multicentric mixed-type Castleman disease variant of POEMS syndrome. Hematol Transfus Cell Ther. 2020;(x x):7–10. https://doi.org/10.1016/j.htct.2020.01.007.
15. Lau YH, Mohd Unit H, Lee LP, Loh WK, Hiew FL. Temporal dispersion in demyelination of POEMS syndrome and Castleman disease. Clin Neurophysiol Pract. 2020;5:112–7. https://doi.org/10.1016/j.cnp.2020.05.001.
16. Oehadian A, Prasetya D, Fadjari TH. POEMS syndrome: a rare case of monoclonal plasmaproliferative disorder. Acta Med Indones. 2010;42(2):100–3.
17. Low JM, Binti Basiam S, Binti Kori AN. POEMS syndrome: A rare paraneoplastic presentation of spinal plasmacytoma. Med J Malaysia. 2019;74(4):335–7.
18. Gao XM, Chang JM. POEMS syndrome: A case report. J Clin Dermatol. 2010;39(11):708–10.
19. Jindahra P, Dejthevaporn C, Niparuck P, et al. Atypical central retinal artery occlusion as the first presentation of POEMS syndrome: A case report. BMC Neurol. 2018;18(1):4–10. https://doi.org/10.1186/s12883-018-1071-y.
20. Rathakrishnan R, Liu TC, Chan YC, Ong BKC. POEMS syndrome - A case for more aggressive treatment. Ann Acad Med Singapore. 2007;36(6):435–7.
21. Chen XF, Ong NWR, Tang PY, Pang SM, Sittampalam K. Glomeruloid haemangioma pattern in reactive angioendotheliomatosis leading to the diagnosis of POEMS syndrome. Pathology. 2020;(xxx):10–12. https://doi.org/10.1016/j.pathol.2020.07.016.
22. Wade BJ. Spatial analysis of global prevalence of multiple sclerosis suggests need for an updated prevalence scale. Mult Scler Int. 2014;2014:1–7. https://doi.org/10.1155/2014/124578.
23. Evidente VGH, Lyons MK, Wheeler M, et al. First case of X-linked dystonia-parkinsonism ("Lubag") to demonstrate a response to bilateral pallidal stimulation. Mov Disord. 2007;22(12):1790–3. https://doi.org/10.1002/mds.21420.
24. Jaffe K, ter Horst E, Gunn LH, Zambrano JD, Molina G. A network analysis of research productivity by country, discipline, and wealth. PLoS ONE. 2020;15(5):1–15. https://doi.org/10.1371/journal.pone.0232458.
25. Sung JY, Kuwabara S, Ogawara K, Kanai K, Hattori T. Patterns of nerve conduction abnormalities in poems syndrome. Muscle Nerve. 2002;26(2):189–93. https://doi.org/10.1002/mus.10182.
26. Misawa S, Sato Y, Katayama K, et al. Safety and efficacy of thalidomide in patients with POEMS syndrome: a multicentre, randomised, double-blind, placebo-controlled trial. Lancet Neurol. 2016;15(11):1129–37. https://doi.org/10.1016/S1474-4422(16)30157-0.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.