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A Review of Secondary Health Conditions in Post-Polio Syndrome: Prevalence and Effects of Aging

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Abstract

Objective—This study seeks to better understand the prevalence and severity of secondary health conditions in individuals with post-polio syndrome (PPS), and the association between these conditions and aging.

Design—A scoping literature review was conducted searching electronic databases for studies published from 1986 – 2011. The scoping review provided information regarding the prevalence and associations of secondary health conditions in PPS with age or other duration-related variables.

Results—The findings indicate that: (1) individuals with PPS experience a number of serious secondary health conditions; (2) the most common conditions or symptoms are fatigue, pain, respiratory and sleep complaints, and increased risk of falls; (3) reports of the associations between the frequency or severity of conditions and age-related factors are variable, perhaps because of methodological inconsistencies between studies; and (4) there is a marked lack of longitudinal research examining the natural course of health conditions in people aging with PPS.

Conclusions—Longitudinal research is needed to understand the course of health conditions and the impact of multiple secondary conditions in people aging with PPS. Efforts are also needed to develop and test the efficacy of interventions to prevent these health secondary conditions or reduce their negative impact.

Keywords

Post-Polio Syndrome; Secondary Conditions; Aging; Scoping Review

INTRODUCTION

The trajectory of disability and aging interact in complex ways across the life span.¹ Some people, such as those with multiple sclerosis, first experience disability early in life. These individuals cope with neurologic change throughout their adult lives; they are aging *with*

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disability. Others may be able-bodied from childhood to older adulthood, only to experience new health conditions (such as stroke or osteoarthritis) resulting in late life disability. These individuals are aging *into* disability. Individuals with post-polio syndrome (PPS) experience a different time course than either of these examples, with early disability, a period of recovery or stability and then a later onset of new weakness. The experience of disability and its impact on quality of life may differ depending on the time course of development.

The average age of those with disability is increasing^{2,3} and the rehabilitation community has the challenge of maintaining quality of life in the face of that disability. One approach to meeting this challenge is to prevent, delay or mitigate the effect of secondary health conditions.⁴ People with PPS experience a number of secondary conditions that influence both their health status and quality of life.^{5,6} Although there are many definitions for the ‘secondary conditions,’⁷ the Institute of Medicine (IOM) defines it as “a condition that is causally related to a disabling condition (i.e., occurs as the result of a primary disabling condition) and that can either be a pathology, an impairment, a functional limitation, or an additional disability (p.214).⁸ This definition distinguishes a secondary condition from associated symptoms that typically accompany the condition of interest and are integral to the diagnostic process. For example, new weakness in someone with a history of polio suggests the onset of PPS, and thus is not considered a secondary condition because it is a key feature of PPS that supports diagnosis of the condition. The IOM definition also distinguishes secondary conditions from comorbidities or medical conditions independent of the condition of interest; for example, hypertension may occur independently of PPS. Comorbidities may reflect the total burden of the disease. Researchers stress the distinction between secondary conditions and comorbidity; because secondary conditions, by definition, occur after the diagnosis, they may be preventable and/or treatable.

Clinicians need to remain vigilant to identify early signs of secondary conditions in individuals with physical disabilities, and to intervene early when possible in efforts to minimize severity and the negative impact of these conditions. Targeting surveillance to catch conditions more likely to occur or most detrimental to patient health and well-being requires knowledge regarding the overall frequency of secondary health conditions in PPS, as well as their course and association with age and PPS duration. Scoping reviews are well-suited for the study of secondary conditions in PPS, because they are designed to map the state of evidence on a particular topic perhaps leading to new research or a systematic review.⁹ This scoping review is one of a series of scoping literature reviews designed to investigate secondary conditions and their associations with aging with a disability^{10,11} and seeks to address the following questions: (1) When, following the diagnosis of PPS, are secondary health conditions most likely to emerge and are they likely to worsen, resolve, or remain stable over time?; (2) What secondary health conditions are most common and thus important to select as primary targets of treatment for enhancing community participation and quality of life?; and (3) What knowledge exists regarding the overall prevalence, course, and impact of these conditions?

METHODS

Search Criteria

For this review, we searched for peer-reviewed studies in PubMed, CINAHL, and PsycINFO. We restricted the search to articles published in English between 1986 and 2011 about human adults with PPS. During the initial comprehensive review process, we included all study types and study designs. We used a specific set of MESH terms (N=169) for an extensive list of potential secondary conditions generated by the authors (available from the corresponding author). We then searched for articles that provided information regarding each secondary condition independently. This preliminary search identified 329 articles related to secondary conditions in adults with post-polio syndrome.

Criteria and Methods for Inclusion

In order to find the most relevant articles about secondary conditions, we applied a set of specific inclusion criteria. These criteria helped to limit the number of articles to those that specifically addressed a particular secondary condition or set of conditions of interest and included:

1. The primary or secondary purpose of the article addressed prevalence, incidence, frequency, duration or course.
2. The focus of the article was on secondary conditions, rather than the prevention of PPS or risk factors associated with polio.
3. The sample size was greater than 5, and the results for adults with PPS were reported separately from other disabling conditions.

Two reviewers applied these criteria and excluded reviews, dissertations, abstracts, conference proceedings, commentaries, and duplicates. When a study did not meet these criteria, it was excluded from further review. If the reviewers could not make a clear determination about inclusion, then the full article was reviewed. Based upon these criteria, 22 were included and these full-text articles were reviewed.

Data Extraction and Outcome Measures

Two reviewers extracted data from the full-text articles, including information about the research design, sample demographics, outcome measures, control variables, and main outcomes related to frequency, severity or course of a secondary condition or set of secondary conditions. We compiled this in a Microsoft ACCESS database specifically designed for this project. An independent reviewer then confirmed the accuracy of this extracted data.

RESULTS AND DISCUSSION

Prevalence and Frequency

Table 1 summarizes the key findings from the 22 articles regarding prevalence of specific secondary health conditions in adults with PPS including the number of articles reviewed as well as information about each articles' publication year, sample size range, and key

findings regarding secondary condition prevalence and associations with age-related variables. The most common conditions -- those reported with a 40% or more prevalence in at least one study -- are fatigue, pain, depression, respiratory and sleep disorders, falls, bone disorders, and bladder dysfunction.

Age and Duration-Related Effects

A number of studies examined the concurrent associations between chronological age, duration of disease and prevalence/impact of secondary conditions. Although not the same construct, age and disease duration are related, depending on a person's age at diagnosis. Disease severity and course are also of interest because they may change with increasing age or duration. The relationships between secondary conditions and age or duration of disease reported in the studies are inconsistent. For example one study¹² found no significant correlation between fatigue and age, but another study¹³ found that fatigue was less common in individuals diagnosed between 43 and 57 years of age, relative to individuals diagnosed at an earlier age. More consistent findings were found for other conditions. For example, rates of both sleep disorders and diabetes increase with duration of PPS.

PPS duration and chronological age are likely strongly associated. Because of this association, when one of these variables is not controlled for in an analysis – which is the case in almost all of the studies reviewed – it is not possible to conclude if a significant effect is due to chronological age or PPS duration. On the other hand, if age or duration is significantly associated with the prevalence of a condition, they can be considered risk factors for that condition. As a corollary, the lack of a significant association can be used as evidence that a causal relationship between age or duration and condition prevalence is unlikely.

Fatigue is the most common secondary condition reported, with prevalence reports ranging from 48– 93% (See Table 1). Studies report that fatigue is associated with depression and other health problems, but no clear association with gender or age has emerged. Pain is also reported as a common secondary condition with prevalence ranging from 34 – 91%. Multiple pain sites were commonly reported.¹⁴ Although comparisons with normative (i.e., individuals without a history of polio) samples were not available, one study reported that a PPS group reported both more fatigue and pain than a polio group not diagnosed with PPS.¹⁵ Depression was the only secondary condition where a comparison with nondisabled normative sample was made. In two studies, individuals with PPS were found to have more depression than either healthy controls or polio survivors without PPS.^{12,15} The pattern of results for the remainder of the secondary conditions evaluated is similar to those for the most commonly reported conditions, fatigue and pain. That is, there was a wide range of prevalence rates reported, and inconsistent findings with respect to the associations of each condition and age or duration-related variables. The exceptions to this finding are due to a condition being examined in only a single study.

CONCLUSIONS AND IMPLICATIONS

The key findings from this scoping review include the following: (1) people with PPS experience a large number of serious secondary health conditions, including fatigue, pain,

depression, muscle weakness, pulmonary and sleep disorders, and falls; (2) although comparisons with normative samples are rare, one study suggests that depression has a greater impact on the lives of people with PPS than on the general population; and (3) a number of methodological issues limit our ability to interpret the findings related to the associations between secondary conditions and aging.

Lack of knowledge about the timing of development and prevalence of secondary health conditions creates important gaps in our ability to serve the rehabilitation needs of people with PPS. These knowledge gaps are appropriate targets for future research. In particular, more research is needed to help understand if and when secondary conditions are most likely to emerge as individuals with PPS age. However, because of the confounding effects of duration of disability and aging,¹⁶ it is important to examine *both* disability duration (time since onset of PPS symptoms) and chronological age when examining the effects of aging on functioning and secondary conditions. Determining the importance of each of these factors will help clinicians better predict when a secondary condition is most likely to emerge. Comparisons of the frequency and severity of secondary conditions with normative samples across age cohorts is also needed to disentangle the process of typical aging from that of aging with PPS.

In particular, there is a need for longitudinal research. The majority of studies identified in this scoping review employed cross-sectional research designs that compared functioning or the frequency of conditions across different age cohorts. A major limitation of such a design is that any differences found may be due to age cohort effects (e.g., differences in the health habits, such as diet, exercise, and smoking) rather than the effects of age *per se*.⁸

A primary reason to build our understanding of the prevalence and time course of secondary conditions in PPS is that such research provides an important empirical basis for further investigation of the management of secondary health conditions in people with PPS. For example, a primary health promotion activity is exercise. However, this activity may be a risk rather than preventive factor in people with PPS.⁴ Research is needed to help identify and test additional health promotion interventions such as weight management and nutrition, or tobacco and alcohol abuse prevention. These interventions may prevent the onset of certain health conditions, lower their severity, and minimize their impact. Although a number of pharmacologic interventions for various symptoms have been proposed, none has definitively shown efficacy versus controls.^{16,17} The most effective interventions for post-polio remain non-fatiguing exercise, energy conservation techniques, and use of appropriate bracing and assistive devices.¹⁸

The current scoping review has a number of limitations that should be considered when interpreting these results. First, because a highly specific set of MESH terms were used in the searches, there may be studies that provide information about the frequency or course of secondary health conditions in people with PPS that were not identified. Similarly, like all literature reviews of this nature, we were limited by the search engines with regards to what evidence we identified, and our analysis is limited by the articles identified. A systematic, as opposed to scoping review, would be helpful to more fully examine the frequency and

course of secondary conditions, as well as assess and grade the evidence found in this review for each particular secondary condition independently.

Despite these limitations, the review has identified a number of secondary health conditions that are common in individuals with PPS and that likely have significant negative impact on their overall quality of life. The review also highlights gaps in the research literature; in particular, gaps in our understanding of the developmental course of secondary health conditions over time. Additional research comparing the frequency and severity of secondary health conditions in individuals with PPS to age-matched normative samples and that tracks the development and course of these conditions over time in longitudinal studies is urgently needed. Such research will help clinicians know when they might expect to see these conditions emerge, and perhaps better prepare patients so as to prevent the conditions and minimize their negative impact when possible.

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Table 1

Prevalence of secondary conditions in post-polio syndrome.

Secondary Condition	Articles (#)	Publication Years	Sample Size (Range)	Prevalence	Associations
Fatigue	11	1991-2011	38-1435	Daily general fatigue; 48-93% ^{12,13,15,19,26} Fatigue was a major complaint 14% ²¹ Fatigue report in 93% of women and 72% of men ²² More fatigue in PPS pts than polio pts without diagnosis ¹⁵	Age: No correlation with age ¹² Duration of Disease: Fatigue less common in those diagnosed between 43 & 57 years of age ¹³ Other Associations: Associated with depression, health problems, sleep ²³ Some report gender difference ²² other do not ²³ Mild exercise lessened fatigue in 15% of PPS (compared with 70% control) ¹² Lack of energy more common in depressed patients ¹²
Pain	11	1993-2010	23-700	Pain 72-91% ¹⁴ . Most reported multiple pain sites ¹⁴ . Joint pain 34-84% Back pain 49-63% ^{13,15,19,24,27} PPS group had more pain than polio group not diagnosed with PPS ¹⁵	Duration of Disease: More pain in those affected at an earlier age ²⁷ Other Associations: Gender (more pain in women) ^{21,22} No gender differences for pain intensity ²⁷ More pain in previously affected muscles ²⁶
Respiration	6	1993-2010	21-1453	Respiratory complaints 11-41% ^{19,21,23,25,26,28}	Other Associations: Gender (complaints more common in women) ²¹
Depression	5	1991-2010	22-630	Depression 13-45% ^{15,25,29,30} PPS more depressed than polio survivors without PPS or nondisabled controls ^{12,15}	Other Associations: Employment status; marital status ¹²
Sleep disorders	5	1993-2011	38-1435	Sleep disorders 13-48% ^{21,24-26} Sleep disorder is chief complaint ²¹	Duration of Disease: Worsens over time ²⁰ Other Associations: Those with sleep disorders also report fatigue ²¹
Falls	4	2002-2011	28-305	At least one fall in last year: 50-74% ^{19,31,32}	Age: Not associated with age ³² . Other Associations: As high as 80% of falls resulted in injuries ^{19,31,32} Walking was most common activity prior to fall ³⁵

Secondary Condition	Articles (#)	Publication Years	Sample Size (Range)	Prevalence	Associations
Bone or Joint	3	1992-2009	50-453	Osteoporosis - Hip 9-73% Lumbar spine 6-58% 31,34 Osteoarthritis hand or wrist-severe 13%; mild 68% 35	Age: Varies with age and gender (menopausal status in women) ³¹ Increasing age, lower extremity weakness, high assistive device use, increasing locomotor disability level (current), and ipsilateral hand weakness ³⁵
Cardiovascular Function	3	1996-2011	38-276	Hypertension 10-29% ^{23,25,56} Cardiac failure 7% ²³ Cardiac infarction 6% ²³	Duration of Disease: Rates increase over time ²⁴ Gender (more common in men) ²³
Diabetes	2	2001-2011	168-276	Diabetes 3-36% ^{23,24}	
Bladder Function	1	1996	350	Change in bladder function- (women 52%; men 37%) ²² Frequency (women 37%; men 26.%) ²² Nocturia - (women 35%; men 23%) ²² Hesitancy - (women 56%; men 75%) ²² Change in sexual function - (women 30%; men 32%) ²²	
Skin problems	1	2001	276	Chronic skin problem 15% ²³	Other Associations: Gender (men report higher prevalence) ²³