Parsonage-Turner Syndrome: Clinical and Epidemiological Features From a Hand Surgeon's Perspective

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Abstract

Background: Parsonage-Turner Syndrome (PTS) is a rare but serious condition characterized by spontaneous paresis of the upper extremity, typically lasting several months with variable recovery. With little literature on the behavior of PTS from a hand surgeon's perspective, accurate diagnosis and subsequent counseling of patients with PTS can be challenging.

Methods: This study is a retrospective evaluation of the clinical features of all PTS patients seen over a 9-year period. Data was collected for gender, side affected, handedness, inciting event, clinical presentation, nerve involvement, time taken for recovery, and extent of recovery. **Results:** Thirty-eight adult cases of PTS were identified, representing an incidence of 0.34 per 1000. Fifty-five percent were female, with predomination of right handedness and dominant upper extremity involvement (60% and 58%, respectively). There was an inciting incident identified in 42% of cases, and 37% of these involved surgery. Twenty-nine percent of cases presented without experiencing typical neuropathic pain. There was a predomination of anterior interosseous nerve (AIN) or posterior interosseous nerve (PIN) involvement (42% overall). Only 44% of patients achieved a complete recovery, taking a mean duration of 10 months. **Conclusions:** This study highlights both the rarity and atypical spectrum of clinical presentation of PTS, especially considering the more common involvement found for AIN and PIN. This highlights the likelihood that patients presenting with PTS to a hand surgical practice may differ from those typically described in the literature. The poor rate of recovery is in line with other recent reports and contrasts with the more positive outcomes found in earlier studies.

Keywords: Parsonage-Turner Syndrome, neuralgic amyotrophy

Introduction

Parsonage-Turner Syndrome (PTS) is the eponymous name given to cases of neuralgic amyotrophy that were extensively documented by Parsonage and Turner in their definitive case series published in 1948.¹⁰ The syndrome is characterized by spontaneous pain arising around the shoulder girdle that typically lasts between 3 to 4 weeks, followed by focal weakness and subsequent muscle wasting that lasts for several months before a variable recovery.^{16,17,19} The pattern of nerve involvement is highly variable but typically affects the upper and middle trunks of the brachial plexus with a reported predilection for the suprascapular and long thoracic nerves.¹⁵ Since its original description, PTS (synonymous with brachial plexus neuritis or acute brachial neuropathy) has been found to be a relatively rare condition with an incidence of 2 to 3 cases per 100 000 per year.¹⁷ There are both idiopathic and heritable variants, and it is thought to arise in susceptible individuals after exposure to some form of autoimmune trigger that targets specific components of the peripheral nervous system.^{1,3,7,17,18}

Despite its well-established profile in the field of neurology, there is comparatively little coverage of PTS in hand surgery literature.^{2,4} Indeed, given its diversity of presentation, relative rarity, and symptom overlap with other common hand surgical problems (such as solitary or multiple compressive neuropathies), PTS can be a difficult entity to diagnose.^{1-4,7,8,15} Careful assessment is required to successfully distinguish PTS from conditions with a similar presentation. Studies suggest that early identification permits medical treatment that may abrogate the severity of the subsequent clinical course.²⁰ Even more importantly, one needs to establish expected outcomes after diagnosis of PTS to enable better and more specific prognostication from a hand surgeon's perspective, rather than rely on neurological

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literature reflecting general outcomes of all affected nerves in the body. This study seeks to address these issues.

Materials and Methods

The project was subjected to ethics board review and proceeded after full approval had been awarded. The clinical records of patients presenting to our institution were retrospectively reviewed to isolate cases of PTS that presented over the 9-year time period between 2003 and 2011. Patients were all above the age of 18 years and presented with a typical history of acute onset of motor palsy with no history of trauma to the region of the nerve affected. All patients underwent full history and physical examination by a hand surgeon to exclude causes such as compressive neuropathy. When deemed appropriate, patients underwent magnetic resonance imaging (MRI) evaluation of the brachial plexus and/or involved extremity to rule out structural pathology such as nerve compression, entrapment, trauma, or tumors. All patients were then referred to a neurologist who independently performed a clinical assessment as well as electrophysiological studies to determine the location and the pathophysiology of the disorder. Patients were excluded if there was a clear history of trauma to the region of the brachial plexus or the affected nerve, or if there was an identified alternative cause for neurologic deficits as found on clinical examination, electrophysiology, or imaging studies. In short, a patient was diagnosed to have PTS based on a characteristic presentation of acute single or multiple nerve motor palsy in the upper extremity, and after exhausting all other potential causes based on history, clinical evaluation, and appropriate investigations.

The study was based on a historical cohort of all patients seen in a large exclusive hand surgery practice over a period of 9 years. In each case, information was sought regarding potential precipitating causes such as recent surgery, illness, infection, or recent childbirth occurring prior to the onset of pain and paresis.^{6,19} In instances where this was the case, a record was made of the time interval between the precipitating factor and onset of nerve palsy. Data were collected for the presence, location, duration, and severity of initial pain, together with information on sensory disturbance and location. Muscle weakness was classified according to the Medical Research Council (MRC) scale (0-5) and correlated to the affected motor nerve supplying the involved muscle group.

All of our patients were initially managed conservatively. Treatment modalities included physiotherapy in the form of range of motion and strengthening exercises, combined with the use of appropriate splints and Neuromuscular Electrical Stimulation (NMES). The use of NMES was primarily directed toward keeping the motor end plates viable while awaiting recovery from the palsy. Therapy was continued till such time that a patient either recovered fully or

Table 1. Frequency and Location of Pain at the Onset of a Parsonage-Turner Attack.

Site of pain	No. of cases	%
Shoulder and scapular region	20	53
Arm and elbow	5	13
Neck pain	2	5
No pain	11	29

Table 2. Inciting Events That Preceded the Development of Parsonage-Turner Syndrome.

Inciting incident	No. of cases	%
Surgery	12	32
Infection	2	5
Surgery + cancer	2	5

demonstrated a plateau in improvement for a period of 3 months. Data were then recorded for the duration of pain and the time taken for motor recovery in addition to the degree of strength regained. Recovery was classified in accordance with the system used by van Alfen by dividing patients into groups based on the time to recovery (group I, 0-6 months; group II, 6 months-1 year; group III, 1-2 years; group IV, >2 years).¹⁹ Similarly, patients were also categorized based on their final recovery into 4 groups (complete recovery with no residual pain—MRC grade 5, complete recovery with residual pain—MRC grade 5, moderate recovery—MRC grade 4, poor recovery—MRC grade 4 or less).

Results

In the included 9-year study period between 2003 and 2011, a total of 112 000 new patients were seen in our practice. Out of these, 38 patients fitted the clinical and investigative criteria outlined above and were diagnosed with PTS. Consequently, the incidence rate of PTS was determined to be 34 per 100 000 upper extremity referrals (0.034%). Among the included participants, there were 17 male and 21 female patients, with an average age at diagnosis of 47 years (range = 31-69 years). The dominant side was affected in 58% of cases, and 60% were right handed. The average duration of follow-up was 13 months (range = 3-36 months).

The most frequent initial event heralding PTS was pain, and this was seen in 71% of patients. The commonest site of pain was in the shoulder and scapular region and was seen in 53% (20 of 38 patients; Table 1). In addition, some form of sensory symptom, including hypoesthesia or paresthesia, was seen in 89% of patients. Sixteen patients (42%) had a clearly identifiable inciting event that preceded the development of PTS (Table 2). In 14 patients (37%), the inciting cause was a previous surgical procedure, and the average

Table 3. The Frequency of Nerve Involvement in the Participants Included in the Study Based on Clinical Findings and Nerve Conduction Studies (Ordered by Decreasing Frequency).

Involved nerve	No. of cases	%
PIN	9	24
AIN	7	18
Axillary nerve	5	13
Radial nerve	4	11
Pan-plexopathy	3	11
Ulnar nerve	3	8
Median nerve	2	5
Suprascapular nerve	2	5
Musculocutaneous nerve	2	5
Accessory nerve	1	2.5

Note. PIN, posterior interosseous nerve; AIN, anterior interosseous nerve.

interval between the surgical procedure and onset of symptoms was 3 days (range = 1-14 days). There was no anatomical correlation between the site of surgery and the nerves involved in the palsy. Table 3 presents the breakdown of predominant motor nerve involvement. These data were collated from the nerve conduction and needle electromyography (EMG) studies that all patients underwent. Typically, nerve conduction studies demonstrated both reduced compound muscle action potential (CMAP) and sensory nerve action potential (SNAP) amplitudes consistent with axonal involvement. Further signs of denervation of target muscles included fibrillation potentials and positive sharp waves on needle EMG. The presence of polyphasic motor units on voluntary contraction, indicative of reinnervation, was often seen on needle EMG several weeks after onset of paralysis. In some cases, reduced motor unit recruitment was seen without denervation changes, suggesting partial conduction block at the brachial plexus.

All patients were followed up until either full recovery was achieved or until recovery was deemed to have plateaued for a period of 3 months or more. Eleven patients regained MRC grade 5 in affected muscle groups, giving a complete recovery rate in this series of 44% (Table 4). Fourteen other patients regained MRC grade 4 muscle strength. Thus, overall 25 of 38 patients (65%) regained useful motor recovery of MRC grade 4 or more without any surgical intervention. Five patients still had residual pain at the time of final follow-up. The timing of recovery ranged between 45 and 740 days with a mean of 303 days (Table 5). Five patients underwent surgical procedures after the diagnosis of PTS was made. One patient underwent a transfer of the ring flexor digitorum superficialis (FDS) to the index flexor digitorum profundus (FDP), while another underwent a ring FDS to flexor pollicis longus (FPL) transfer for persistent anterior interosseous nerve (AIN) palsy. A third patient underwent tendon transfers for persistent posterior

Table 4. Patient Classification Into 1 of 4 Groups Based on Their Level of Recovery in Accordance With the Grading System Used by Van Alfen et al.¹⁸

Level of recovery	No. of patients
Complete recovery with no residual pain (Power 5/5)	6
Complete recovery with some residual pain (Power 5/5)	5
Partial recovery with or without residual pain (Power 4/5)	7
Poor recovery with or without residual pain (Power 3/5)	7

Table 5. Delay to Full Recovery Broken Down Into 4 Groups Based on Timescale.

Group	No. of months to recovery	No. of patients
I	0-6 months	5
II	6 months-1 year	3
III	1-2 years	2
IV	More than 2 years	1

interosseous nerve (PIN) palsy associated with poor wrist and finger extension. Two patients had release for concurrent compressive neuropathy—1 cubital tunnel and 1 radial tunnel release. None of these patients had a relapse of PTS following these surgical procedures.

Discussion

The clinical characteristics of PTS are noteworthy not only for the inherent variability of individual presentation but also by the overall signature characteristic of spontaneous shoulder girdle pain preceding paresis in the upper limb.^{4,12,14,22} When combining the comparative rarity of PTS (1000 times lower incidence than that for carpal tunnel syndrome) and paucity of its coverage in the hand surgery literature, the hand physician may face considerable difficulty in both recognizing the condition and having the information necessary to counsel the patient regarding the likely clinical course and recovery to be expected. Indeed, in a recent neurology report, 30 cases of PTS took at least 3 consults to secure the diagnosis (of which none were made by orthopedic surgeons in 11 cases), with a median delay of 60 days.² In the present study, although there was a wide variation in delay to diagnosis, the median time to diagnosis was 33% longer than this at 90 days. This is largely due to the fact that the diagnosis of PTS was made only after the patient was referred to our center, which in many cases was a considerable period after the onset of symptoms. In comparing the number of identified cases of PTS against the overall patient workload over the 9-year study period, we calculated an incidence of 32 cases per 100 000 referred patients, which is around 10-fold higher than that reported in literature for the

general population (2-3 per 100000).¹⁷ This higher incidence can be explained in part by the selection bias of individuals with upper extremity pathology, in addition to the referral nature of our practice which is an exclusive hand surgical practice, seeing around 250 patients a day, and receiving routine referrals from at least 6 states and from multiple level 1 trauma center and regional medical centers. Consequently, our data accurately reflect the likelihood of encountering PTS in a large referral hand surgical practice. Further bolstering our data is the observation made in a large review of PTS by van Alfen who argued that "under-recognition and misdiagnosis are frequent and the true annual incidence could be at least 20-30 cases per 100000 individuals."^{17(p315)}

When evaluating a patient for possible PTS, the history should include a search for recent infection (including Epstein-Barr, Varicella Zoster, Dengue, and Hepatitis E viruses), immunization (tetanus toxoid, influenza), recent childbirth, prescribed medication (antiepileptics, antibiotics, immunosuppressants, antiretrovirals, and botulinum toxin), and all forms of surgery.^{6,12,16,17} All of these are well documented to precede the onset of an attack of PTS and offer a valuable pointer toward the diagnosis if present, as was the case for surgery (37%) and infection (5%) in our series. Having decided upon a possible diagnosis of PTS, MRI imaging can be of use in ruling out alternative pathologies, including shoulder pathology or extrinsic nerve compression.¹¹ MRI also has the ability to directly support a diagnosis of PTS by documenting abnormalities suggestive of denervation, including edema, atrophy, and wasting in affected shoulder girdle muscles.¹³ Electrophysiology studies may demonstrate different findings depending on the underlying pathology, conduction block, demyelination, or Wallerian degeneration that may occur in varying combinations.^{5,18} It may take up to 2 to 3 weeks for signs of denervation to appear (earlier in proximal muscles), and hence, appropriate timing of EMG testing is important. Often denervation changes are most prominent in muscles supplied by a single nerve, but subtle changes may be detected in the distribution of additional nerves, substantiating localization to the brachial plexus. Serial EMG studies are valuable in detecting early signs of reinnervation.

The reported spectrum of nerve involvement associated with PTS is highly variable. Our results demonstrate a predomination of palsies involving AIN and PIN that affected more than 42% of the cases studied. This proportion of isolated peripheral nerve involvement is high when considered against other literature reports, including just 6 cases of AIN involvement in Parsonage and Turners' original series of 136 patients. Our explanation for this epidemiological variance is the selective nature of the referral process to a hand surgeon, while a patient with shoulder girdle symptomatology is likely to be referred to a sports surgeon, shoulder surgeon, or general orthopedic surgeon. Maintaining a high index of suspicion is crucial for detecting the uncommon cases of

PTS that manifest with no severe initial pain as was the case in 29% of the patients in the present study. The underlying neuritis in PTS is not restricted to motor axons; the rate of sensory involvement in the present work (89% overall) is consistent with the high frequency of sensory disturbance reported in the literature.^{14,18}

Effective treatment for PTS remains a distant ideal, but recent works have concentrated on abrogating the disease course with steroid and immunoglobulin therapy.^{16,21} In a recent Cochrane update on PTS treatment, only 1 open-label retrospective study demonstrated a possible benefit from steroid administration if given within 1 month of symptom development, with earlier pain resolution and faster recovery in some patients.²⁰ The high cost and associated problems with insurance reimbursement precluded the use of pharmacological agents such as immunomodulators in our series. Otherwise, general supportive measures are the mainstay, including pain relief through combinations of long-acting nonsteroidal anti-inflammatory drugs (NSAIDs), opiates, carbamazepine, gabapentin, and amitriptyline, in addition to physiotherapy. In one study of 5 cases of PTS without recovery, surgical exploration of affected peripheral nerves found hourglass-like thickening that responded well to neurolysis or resection with interposition grafting on follow-up.⁹ None of the patients in our series underwent surgical exploration of the affected nerves.

In considering the recovery from an attack of PTS, our study echoes the rates reported in more recent outcome study reports, with 65% making a recovery of grade 4 or more and only 44% of patients making a full recovery. However, we found no correlation between a delay to diagnosis and chances of complete recovery, and perhaps this is as would be expected in a condition generally managed by supportive measures alone.

In summary, our study has demonstrated the clinicoepidemiological profile of PTS from a hand surgeon's perspective. An incidence of 0.034% indicates the rarity of this condition within a general upper extremity referral base; but at 10-fold higher than the general population, this demonstrates that a dedicated hand surgery service is likely to see a much larger incidence than is otherwise reported in general literature. The more common involvement of AIN and PIN highlights the fact that patients presenting with PTS to a hand surgical practice may differ from those typically described in literature.

In conclusion, the relatively confusing nature of the PTS often leaves patients puzzled and in need for answers regarding prognosis. This study has enabled us to engage our hand surgery patients in a better and more meaningful dialogue regarding expected outcomes in this condition. Our study concludes that overall, 65% of patients can be expected to regain a functional level of recovery of MRC grade 4 or more at a mean period of 10 months following diagnosis.

Authors' Note

Work performed in the United States.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

This was a retrospective chart review. Hence a specific consent for this study was not obtained. However, all patients seen in our practice signed a form acknowledging that their data (de-identified) may be used for research purposes.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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