Hand involvement in Navajo neurohepatopathy: a case report

Tahseen A. Cheema · Scott Swanson

Published online: 19 November 2010
© American Association for Hand Surgery 2010

Abstract We report a case of Navajo neurohepatopathy with severe involvement of the hands. It is a progressive sensorimotor neuropathy with distal weakness, areflexia, and reduced sensation in the extremities associated with acral mutilation. The role of possible surgical intervention is demonstrated in this case.

Keywords Hereditary peripheral neuropathy · Intrinsic paralysis · Navaho neurohepatopathy

Introduction

Navajo neurohepatopathy (NNH) is an autosomal recessive multisystem disorder prevalent in the Navajo population of southwestern USA. Navajo neuropathy was first described by Appenzeller et al. in 1976 [1], and more detailed description was given by Singleton et al. in 1990 [2]. Salient feature of the disorder included a progressive sensorimotor neuropathy with distal weakness, areflexia, reduced sensation in the extremities associated with corneal ulceration, and acral mutilation. Other features included poor weight gain, short stature, sexual infantilism, serious systemic infections, and liver derangement. Liver derangement is characterized by fulminant hepatic failure, Reye-like syndrome, or indolent progression to liver cirrhosis [2]. Holve et al. observed three clinical phenotypes based on age at

presentation and course of the disease [3]: infantile type with onset before age of 6 months, presented with jaundice and failure to thrive and progressed to liver failure before 2 years of age; childhood type that presented between 1 and 5 years of age with liver dysfunction and progressed to liver failure and death within 6 months; and classical type with variable onset of liver disease but progressive neurological deterioration. While it remains undetermined whether the disease process is primarily a neurologic disorder or a consequence of a metabolic or chemical dysfunction, neuropathy gives a characteristic appearance to the hands.

Due to distal sensorimotor neuropathy, there is striking involvement of hands in this disease characterized by severe intrinsic loss, contractures, and loss of function. There has been no description of this disorder in orthopedic literature. We present a case of a grown-up female patient with severe hand involvement and improvement in function with surgical reconstruction

Case Report

This 27-year-old female patient presented with severe weakness, deformities, and loss of function of both hands. Her height was 127 cm and she appeared emaciated. Her IQ appeared normal given that she had studied up to college level. She was diagnosed of having NNH around age 10. Due to progressive hepatic failure, she underwent liver transplant at 11 years of age. Progressive involvement of the hands made it difficult for her to write or use a computer and necessitated a consultation with hand service. Adjustment of her anti-rejection medications had afforded her 6 months of rejection free episodes prior to the consultation for operative consideration for hand deformities. Physical examination demonstrated complete atrophy

T. A. Cheema (✉) · S. Swanson
Division of Hand Surgery, Department of Orthopaedic Surgery,
MSC10 5600, 1 University of New Mexico,
Albuquerque, NM 87131-0001, USA
e-mail: tcheema@salud.unm.edu

S. Swanson
e-mail: scottswanson@qwest.net

Fig. 1 a, b Right hand in NNH showing severe intrinsic paralysis and flexion deformities of interphalangeal joints

of intrinsic muscles and contracture of proximal interphalangeal joints (PIP) of all fingers in the range of 90° and variable flexion deformities at distal interphalangeal joints (Fig. 1). She had no opposition and only limited ability for side pinch. Her functional disability was related to inability to hold a pen and use a computer. She had lack of sensation in median and ulnar nerve distributions.

The goal of surgical intervention was to improve her prehensile function by providing opposition and correcting severe flexion deformities of the fingers. For this purpose, she underwent flexor digitorum superficialis opponensplasty using the tendon from the ring finger and arthrodesis of PIP joints of the fingers. Arthrodesis of each finger PIP joint was done through a dorsal approach with cup and cone technique using single axial 1 mm size K-wire. The joints were fixed in 20° to 30° flexion, increasing flexion from radial to ulnar sided fingers (Fig. 2). As there was no tendency of metacarpophalangeal joints of the fingers for hyperextension after arthrodesis of PIP joints due to chronic contracture of flexor tendons, intrinsic replacement was not done. The interphalangeal joint of the thumb was manipulated into extension and temporarily fixed with a K-wire.

Post-operatively, sutures were removed at 2 weeks and K-wires were removed at 6 weeks. The patient then began an intensive program of occupational therapy, and at 3 months post-operatively, she was able to turn a key in a door, write with a pen, and open a bottle (Fig. 3). The sensation in hands remains at pre-operative level. At

12 months follow-up, she continues to retain improvement in hand function secondary to surgical intervention and plans to proceed with similar procedure for the other hand.

Discussion

NNH remains a unique and enigmatic problem in Navajo Native Americans. The Navajo Nation is a semi-autonomous Native American homeland covering about 26,000 miles² (67,339 km²), occupying all of northeastern Arizona, the southeastern portion of Utah, and northwestern New Mexico. The 2000 census reported 298,215 Navajo people living throughout the USA, of which 173,987 (58.34%) were within the Navajo Nation boundaries. The western half of the reservation, including the communities of Tuba City, Chinle, Kayenta, and Winslow, contains 40% of the population. The eastern reservation with communities of Gallup, Shiprock, and Crownpoint is mostly in New Mexico and contains 60% of the population. Because of the close proximity of the eastern reservation to major communities outside the reservation, the Navajo people in the eastern reservation had earlier contact with western culture. The western reservation has remained more remote with restricted access until the past 20 to 30 years. According to Singleton et al., the incidence of NNH on the western Navajo reservation is five times higher than that on eastern reservation (38 compared with seven cases per 100,000

Fig. 2 a, b After FDS opponensplasty and arthrodesis of PIP joints

Fig. 3 **a, b** Functional improvement 3 months post-operatively

births) [2]. Mitochondrial DNA depletion was detected in the livers of two families with NNH by Karadimas et al., suggesting linkage to chromosome 2p24. This locus includes the MPV 17 gene, which, when mutated, causes a hepatocerebral form of mitochondria DNA depletion [4].

Hereditary peripheral neuropathies are manifestations of peripheral nerve dysfunction resulting from Schwann cells and their myelin sheaths degeneration [5]. Sural nerve biopsy in cases of NNH has shown severe loss of myelinated fibers with degeneration and regeneration of nonmyelinated axons [2]. Except for the motor disorder, these patients resemble those with congenital sensory neuropathy. Most patients with congenital sensory neuropathy have normal motor strength. The most common hereditary peripheral neuropathy with motor manifestation is Charcot–Marie–Tooth disease in which weakness of intrinsic muscles generally occurs late in the course of the disease [5]. However, the severe motor disorder, corneal ulcerations, metabolic derangements, and liver involvement make NNH a distinct entity.

Patients who survive into adulthood often have intrinsic paralysis and deformities of the hands causing severe disability. Judicious use of surgical intervention can provide

significant relief and improvement in functional capacity of the hand in these patients. In our patient, opponensplasty and correction of severe flexion deformities at proximal interphalangeal joints of the fingers improved the prehensile function and helped the patient to carry out activities of daily living.

The purpose of this case report is to bring to the attention of hand surgeons this unusual entity and present our described approach as a possible surgical treatment.

References

1. Appenzeller O, Kornfeld M, Snyder R. Acromutilating, paralyzing neuropathy with corneal ulceration in Navajo children. *Arch Neurol.* 1976;33(11):733–8.
2. Singleton R, Helgerson SD, Snyder RD, O'Conner PJ, Nelson S, Johnsen SD, et al. Neuropathy in Navajo children: clinical and epidemiologic features. *Neurology.* 1990;40(2):363–7.
3. Holve S, Hu D, Shub M, Tyson RW, Sokol RJ. Liver disease in Navajo neuropathy. *J Pediatr.* 1999;135(4):482–93.
4. Karadimas CL, Vu TH, Holve SA, Chronopoulou P, Quinzii C, Johnsen SD, et al. Navajo neurohepatopathy is caused by a mutation in the MPV17 gene. *Am J Hum Genet.* 2006;79(3):544–8.
5. Warner LE, Garcia CA, Lupski JR. Hereditary peripheral neuropathies: clinical forms, genetics, and molecular mechanisms. *Annu Rev Med.* 1999;50:263–75.