Muscular Dystrophy Canada
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Hereditary Motor and Sensory Neuropathy with Agenesis of the Corpus Callosum

This brochure on Hereditary Motor and Sensory Neuropathy with Agenesis of the Corpus Callosum presents an overall description of the symptoms associated with the disorder and of its effects on the people affected at different stages of their lives. Should you have any questions after this reading, please contact the resource services listed at the end of this document.

What are the symptoms of HMSN/ ACC? How does the disease progress?

What is Hereditary Motor and Sensory Neuropathy with Agenesis of the Corpus Callosum?

Hereditary Motor and Sensory Neuropathy with Agenesis of the Corpus Callosum (HMSN/ACC) is a progressive hereditary neuromuscular disorder that mainly affects people from the Saguenay-Lac-St-Jean (SLSJ) and Charlevoix regions of Quebec, as well as people whose ancestors are native to these regions. Some cases of HMSN/ACC have also been identified in others countries. HMSN/ACC is responsible of the degeneration of the peripheral nerves involved in both body movement and the perception of sensations. Irregularities are also observed in the brain of the people living with the HMSN/ACC, predominantly in the anatomical structure interconnecting the two cerebral hemispheres, known as the corpus callosum. The corpus callosum is found to be totally absent in 57.8% of patients, partially absent in 9.4% of them, and normally present in 32.8% of people living with the disorder.

Men and women are equally affected. There are more than one hundred people living with HMSN/ACC in Quebec, most of whom are localized in the SLSJ and Charlevoix regions.

Symptoms appear shortly after birth or during the first year of life and are characterized by a lack of muscular strength and a delay in the development of psychomotor skills. HMSN/ACC is a slowly progressive disorder. It results in a loss of mobility as well as backbone, hands and feet deformities. All people with the condition show a light to moderate mental retardation. Presence or absence of corpus callosum in the brain of people affected does not seem to influence the severity or the nature of symptoms.

Infant children are less physically active than other children of their age group. They have difficulties sitting and crawling. An intensive physiotherapy and occupational therapy treatment will stimulate motor development. They usually start walking around the age of two or three, with technical aids support: lower limbs orthesis (feet and ankles), walkers, quadripods or support canes. Whether using or not these aids, their gait will remain slow; they have a poor balance and in most cases, tremors are observed on all parts of the body. Once these children are too old to be carried in a stroller, a wheelchair will be necessary.

Regarding the upper limbs, young children will be less prone to use their arms and will often show hypersensitivity at the touch of objects. Fine motor

skills development is slowed. Arm motion and reaching for objects is slower. Handgrip strength is weakened and keeping a grip on an object often requires extra exertion. This weakness in the upper limbs sometimes causes muscle tremor under strain.

Toilet training starts at a later stage and children are seldom ready to do it before age three. They will have a slower awareness to their environment. Language development as well as learning capacity is also slower than normal.

Children will usually follow their kindergarten classes and their first year elementary school in the regular system, with teaching aid support. By the second or third year of elementary school, they will most likely be admitted in a specialized class. Most children with HMSN/ACC will learn how to read, write and count, but academics do not usually go beyond second grade.

Children will demonstrate social and moral judgment; will be able to conform to the codes of conduct and to acquire a valuable general knowledge. They are usually very sociable, hearty and affectionate, a cheerful child who likes group activities and integrates well in the kindergarten environment or the school activities.

In their teen-age years, most of the kids will be able to move around out of home by themselves in a manual wheelchair. An electric scooter will give to those capable of using it an opportunity to move a longer distance. At home or in class, a walker will help with ambulation, sometimes up to the age of twenty or so. At that stage, the home environment must be adapted in order to ease their mobility: outside wheelchair ramp, door access enlargement, adapted tub or bath, etc. Different types of specialized technical aids are also used on a regular basis: electrical bed, electric lifting device, etc. The car will also need to be adapted to facilitate the transportation of the youth in the wheelchair.

At twelve years of age or so, the child will undergo a surgical procedure aimed at correcting the curvature or bending of the spine, or scoliosis. This surgery will allow a better lung and other organ's expansion, as well as a better body alignment. Some youngsters wear a corset for a few years prior to the surgical straightening of the spine in order to postpone the moment when the surgical process will be performed. However, the corset is not a substitute to the surgery.

By the end of their teen-age years or at the beginning of adulthood, some persons might suffer from psychiatric disorders ranging in severity.

What causes HMSN/ACC?

HMSN/ACC is caused by a gene mutation localized in 1996 and identified in 2002 by scientists from Quebec. More than 99% of the persons affected show a common single alteration or mutation in this gene; this mutation can be detected through genetic analysis of a blood sample.

HMSN/ACC is caused by a mutation in a gene located on chromosome 15. This is an autosomal recessive disorder. The term autosomal means that this gene is located on one of 22 pairs of chromosomes defining specific traits not related to sex characteristics. The gene responsible for HMSN/ACC is recessive: This means that in order to have a child with the disorder, both parents must be carriers of the gene; when the two (2) parents are carriers, they have a 1 in 4 (25%) chance to have a child with HMSN/ACC with each pregnancy. (For a complete explanation of autosomal recessive genetics, see the INFO sheet "Genetics: What is Autosomal Recessive"). Carriers of the HMSN/ACC gene show no symptoms of the disorder. Most of these people do not know they are carriers.

Anxiety and agitation episodes, visual or auditory hallucinations and symptoms of depression can occur, requiring a drug treatment. These problems are caused by dysfunctions in the brain. During adulthood, the person affected can move around using an electric wheelchair but they will need assistance for all their personal needs. Weakness in the respiratory muscles results in respiratory failure and a high risk of bronchopneumonia that can sometimes lead to death. Life expectancy is shortened. Average life span is 29 years, although many have lived up to their forties.

What are the risks of having an affected child?

When both parents are carriers of the HMSN/ACC gene, at each pregnancy:

- There is a 1 in 4 (25%) chance that the child will have the disorder.
- There is a 2 in 4 (50%) chance that the child will be a carrier of the gene.
- There is a 1 in 4 (25%) chance that the child will neither have disorder, nor be a carrier of the disorder gene.

How can I know whether I am a carrier of the HMSN/ACC gene?

Parents of a person affected with HMSN/ACC are almost always carriers. The carrier status of the HMSN/ACC gene can be confirmed through genetic testing. This test is available to members of families affected with the disorder and their close relatives. This test may potentially be offered in communities where the risk of being carrier of the HMSN/ACC gene is high.

If you have a family history of HMSN/ACC, you might wish to consult a geneticist or a genetic counsellor. These health professionals will diagnose your chances to have a child affected with HMSN/ACC, will suggest you to take a genetic test, or discuss with you the family planning alternatives you may consider.

When a person is affected with HMSN/ACC:

- To date, no person with this condition has been able to have children. This is explained by the severity of symptoms. Whether the affected persons are normally fecund is not known.

The physical rehabilitation process throughout different stages of life:

Once the diagnosis is confirmed, the children will be assessed in physiotherapy. The physiotherapist will assess motor development, joint mobility and technical aids needs. A regular monitoring of these children during the preschool period will be proposed in order to help develop motor skills (sit, crawl, stand up and walk, with or without technical aids). The follow-up will also help maintain correct posture maintenance, a good range of motion and good muscle strength.

During the schooling period, the children are monitored in physiotherapy, where functional independence relating to transfer and ambulation processes, as well as muscle strength will be assessed. The technical aids used by the children will also be checked and adjusted if needed. In some cases, the children will have to be followed-up again for a short period of time, especially after the scoliosis surgery or during the phase when they start loosing functional independence.

Once the diagnosis is confirmed, the children will be guided and monitored on a regular basis in occupational therapy. This program will help foster motor development, and maintain motor skills. Play and activities related to daily living will be used to improve awareness of the surrounding environment and enhance manual dexterity.

The occupational therapist will propose an early adaptive action at day care in preparation for the social and school integration of these children, and may also recommend a wide range of specialized equipment and changes to make to the physical environment (in day care, at home and in school). Furthermore, the occupational therapist will play an essential role during the school integration and the whole schooling period.

The neurologist will ensure the life-long monitoring of the affected person, and can answer questions from parents regarding the evolution of the disorder. A neurologist can prescribe medications to treat problems that may arise during the course of the disorder.

How is HMSN/ACC diagnosed?

The infant child is diagnosed following a clinical examination from the paediatrician and the neurologist, as well as through the following medical procedures:

- Computed cerebral tomography: an exam of the brain performed with a highly precise radiography
- technology.
- Electromyogram (EMG): an analysis of the electrical activity in the arm and leg muscles.
- Genetic analysis.

The pneumologist will asses the respiratory condition and prescribe appropriate treatments: drugs, inhalation therapy, breathing exercises.

The orthopedic surgeon will assess and treat curvature of the spine (scoliosis) and deformity of the limbs, and in some cases, may recommend wearing a corset and orthesis, also suggesting the appropriate ways to ensure good posture when in a wheelchair.

The nurse will provide all additional information about the disorder and available services and resources. A nurse may offer support to help people with the disorder and their family members cope with the disorder, provide guidance with the administrative processes when required, and liaise with the various health care professionals from the clinic and from other external services (CLSC and others).

The genetic counsellor will provide information about the inheritance processes involved in HMSN/ACC, the genetic testing available to the carriers of the disorder's gene, and the family planning alternatives they may wish to consider.

What are the psychological effects of HMSN/ACC?

Learning that a child is diagnosed with HMSN/ ACC is often an emotional shock for the parents. Rehabilitation professionals will help them become familiar with the exercise or play programs that will foster their child's development. Parents' involvement is crucial in that rehabilitation process. A child with HMSN/ACC needs more care and attention than an unaffected one; he will never be as independent as the other kids. It is suggested that as soon as early childhood, parents look for child care services, arrangements that will permit them to have a break, or regular

babysitting services. That will also help the child develop his social skills and enhance his maturity. As parents often experience tiredness and back pain, these arrangements will also prove to be greatly beneficial to them. A person living with HMSN/ACC goes through challenging phases that have major impacts on their family: back surgery, foster care placement, etc. Each person and each family will adapt differently to these steps that can be facilitated through professional and community support.

Many of these people will live a happy life, surrounded with the love and affectionate care of their family. Even though they are conscious of their "handicap", they will seldom show signs of a great psychological distress related to their condition. They know how to adequately express their needs and feelings. The main social contacts aside from the family will be through school or activities aimed at people with physical and/or mental disabilities. Some of them will even experience love relationships.

Several adults live in foster care or institutional homes. This situation is explained by the aging of the parents and the heavy care these patients need.

What are the treatments for the disorder?

There are currently no treatments able to cure people with HMSN/ACC. However, several health-care professionals acting as a team may help people living with the disorder to maintain or improve their physical abilities and provide their comfort. These professionals work mainly in the following medical fields: occupational therapy, physical therapy, speech therapy, neurology, pneumology, orthopaedics, nursing and genetic counselling.

What about research on HMSN/ACC?

The gene responsible for the disease was discovered in 2002. Research is being pursued in order to better understand the protein produced by this gene, and its function. However, scientists have to get over several steps in order to find a cure or a way to significantly reduce the symptoms associated with that disease.

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What are the main resources available to people living with HMSN/ACC and their families in the populations showing high incidence of the disease?

Clinique des maladies neuromusculaires du Saguenay-Lac St-Jean (Saguenay-Lac-St-Jean Neuromuscular Disorders Clinic) Carrefour de la Santé de Jonquière 2230 rue de l'Hôpital, C.P. 15 Jonquière, QC G7X 7X2 (418) 695-7777

Clinique des maladies neuromusculaires deCharlevoix (Charlevoix Neuromuscular Disorders Clinic) Centre Hospitalier de Charlevoix 74, rue Ambroise-Fafard Baie Saint-Paul, QC G3Z 2J6 (418) 435-5150, ext. 2086 and 2087

Bureau régional de la Dystrophie Musculaire Canada (DMC) (Muscular Dystrophy Canada [MDC] Regional Office) *Fonds ARSACS de l'ACDM 2230, rue de l'Hôpital, C.P. 15, Jonquière, Qc G7X 7X2 (418) 695-7760
*A MDC Funds mainly devoted to research on ARSACS.

Service de conseil génétique (Genetic Counselling Service) Complexe Hospitalier de la Sagamie 305, St- Vallier C.P. 67 Chicoutimi, QC G7H 5H6 (418) 541-1234, ext. 2153 or 2081

Bureau provincial de la Dystrophie musculaire Canada (Muscular Dystrophy Canada Provincial Office) 1425, boul. René-Lévesque Ouest, bureau 506 Montréal, QC H3G 1T7

How can I help?

Muscular Dystrophy Canada conducts year-round fund raising campaigns to support our diverse programs. Your gift will help the Association provide the dollars necessary to assist individuals living with neuromuscular disorders, and fund much needed medical research and educational information. Please make a gift through our National office or any Regional or Community Muscular Dystrophy Canada office.

All Muscular Dystrophy Canada Information Sheets are available on our website: www.muscle.ca

Ce feuillet d'information est aussi disponible en français.