

Angioplasty Used to Treat Multiple Sclerosis Patients: A Potential Revolution in Health Care Technology

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Résumé : (traduction)

La sclérose en plaques (SEP) est depuis longtemps cataloguée comme une maladie neurologique à forte incidence chez les Canadiens, et en particulier chez les femmes. Cette maladie se manifeste initialement au début de l'âge adulte (entre 15 et 40 ans). On trouve des zones de démyélination avec une prolifération d'astrocytes, éparpillées dans la substance blanche des sujets atteints de SEP, et ceci provoque de la faiblesse musculaire, des engourdissements, du déséquilibre, des perturbations du sphincter, et d'autres dysfonctionnements neurologiques. Récemment, le Dr. Paolo Zamboni, un chirurgien vasculaire de l'Université de Ferrare, en Italie, a découvert que beaucoup de patients atteints de SEP présentent un rétrécissement de plusieurs des veines du cou chargées de drainer le sang du cerveau. Selon le Dr. Zamboni, ce rétrécissement des vaisseaux sanguins provoque un dépôt de fer dans les veines défectueuses, diminuant ainsi le flux sanguin et causant certaines complications liées à la SEP. Le Dr. Zamboni a réussi à débloquent ces veines grâce à l'angioplastie, une méthode normalement utilisée pour ouvrir les artères bouchées par l'artériosclérose. Dans le cadre d'un de ses projets de recherche, il a effectué cette procédure sur 65 patients, dont le taux de présence de lésions a diminué de 50% à 12%. Il a également constaté une amélioration de la qualité de vie de ces patients sur les plans mental et physique. L'auteur aborde aussi des questions éthiques dans son article. Les recherches du Dr. Zamboni suggèrent que la SEP peut être causée par des facteurs de patrimoine génétique. Les fournisseurs de soins de santé devraient-ils commencer à rechercher systématiquement ces facteurs chez les nouveaux nés? Ce dépistage devrait-il être obligatoire? Et serait-il gratuit?

Mots-clés :

Sclérose en plaques (SEP), angioplastie, insuffisance veineuse cérébrospinale chronique, fer, sclérose, neurodegeneration

Abstract:

Multiple sclerosis (MS) has long been labeled as a neurological disease with a high incidence among Canadians, women in particular. The disease first manifests itself in young adulthood (between the ages of 15 and 40 years). Areas of demyelination with a proliferation of astrocytes are found scattered in the white matter of MS patients, this leads to muscle weakness, numbness, disequilibrium, sphincter disturbance and other neurological dysfunctions. Recently Dr. Paolo Zamboni, a vascular surgeon at the University of Ferrara in Italy, found that many multiple sclerosis patients have a narrowing of some of the neck veins responsible for draining blood from the brain. According to Dr. Zamboni, this narrowing of the blood vessels leads to the deposit of iron in the defected veins, which restricts blood flow and is responsible for some of the MS complications. Dr. Zamboni achieved unblocking of the veins through angioplasty, a procedure normally used to open arteries affected by atherosclerosis. In one of his trials, 65 patients were given the procedure, which decreased the rate of occurrence of lesions, from 50 % to 12 % in patients. There was an improvement in mental and physical quality of life in most of the patients in this trial. Ethical questions are also discussed in this review. Dr. Zamboni`s studies suggest a genetic inheritance of factors that may lead to MS. Should health care providers institute a screening procedure in newborns? Would these screenings be mandatory? Would the screenings be free?

Keywords:

Multiple Sclerosis (MS), angioplasty, chronic cerebrospinal venous insufficiency, iron, sclerosis, neurodegeneration

Introduction

Multiple sclerosis (MS) is one of the most serious and common neurological conditions today. This disease is characterized by areas of degeneration of the myelin sheaths of nerve fibres in the brain and spinal cord. These degenerated areas heal through sclerosis (scarring), forming multiple sclerotic plaques (Crowley, 2010). For over a century, millions of young adults suffering from this disease have experienced severe disability and potentially reduced lifespan, as the scarring cannot be stopped, and the symptoms may only be managed. Epidemiologic studies indicate that MS is particularly prevalent in persons of western European descent, who live in temperate zones (McPhee, Papadakis, & Tierney, 2001); it tends to occur among young adults between the ages of 15 and 40 (Crowley, 2010). Canada has one of the highest incidence rates of MS in the world. Three Canadians are diagnosed with MS every day, and women are three times more likely to develop MS than men (MS Society of Canada, n.d.).

Multiple Sclerosis patients are separated into three groups based on the progression of the disorder. Relapsing-remitting patients develop new symptoms, or have the first episode reoccur, months or years after the first symptoms emerge. In some of these patients, the clinical course of MS changes into a steady deterioration, this type of progression is called secondary progressive. Finally, primary progressive MS is a less common type of progression, where the onset is early and the disorder develops at a steady pace from its onset (McPhee, Papadakis, & Tierney, 2001). Multiple Sclerosis is characterized by a series of symptoms, these include muscle weakness and spasms, numbness, disequilibrium, retrobulbar neuritis, double vision, and sphincter disturbances, which includes urinary incontinence (McPhee, Papadakis, & Tierney, 2001). Although partial recovery from acute exacerbations can be expected with current treatment, there is no way of preventing the progression of this disorder. Corticosteroids may hasten the recovery from acute relapses. High doses of prednisone (60 to 80 mg) may be given daily for a week, after which medication is tapered over the following two to three weeks (McPhee, Papadakis, & Tierney, 2001).

A treatment that could possibly alter the outcome of MS, this being ultimately death, would be hailed as a miracle in terms of health care technology, by the millions of individuals living with this condition. Dr. Paolo Zamboni, of the University of Ferrara in Italy, is possibly the man that has taken the largest step towards this “miracle” in years. His

research suggests that MS is linked to a vascular condition, rather than an immune system dysfunction (Zamboni et al., 2009), as previously believed. The validation of Dr. Zamboni’s discovery, through extensive research and clinical trials, may potentiate the modification of medical textbooks worldwide.

Dr. Zamboni’s theory has been through extensive research. Trials were conducted, where sixty-five MS patients were divided into groups, based on the different classifications of MS progression; these groups were primary progressive, secondary progressive and relapsing remitting. In his work “A prospective open-label study of endovascular treatment of chronic cerebrospinal venous insufficiency”, he discovered that performing an angioplasty procedure in patients afflicted by chronic cerebrospinal venous insufficiency (CCSVI), associated with MS, is safe and effective in significantly improving MS clinical outcome (Zamboni et al., 2009). Venous pressure was decreased in the targeted vessels with only a minor and negligible complication rate (Zamboni et al., 2009). Some of the parameters observed were the rate of relapse-free patients, the presence of MS lesions, and the improvement in physical and mental quality of life (MS QOL questionnaire) (Zamboni et al., 2009). While results are promising, there is a difference between the groups evaluated; where certain MS types had more evident improvements in the mentioned parameters. Although angioplasty is relatively safe, any invasive procedure has risks associated with it. According to the National Heart Lung and Blood Institute, these risks include bleeding from the targeted vessel, damaging of blood vessel, potential allergic reaction to any of the materials used, arrhythmias, heart attack (3-5% of patients), and stroke (less than 1% of patients) (National Heart Lung and Blood Institute, n.d.).

Dr. Zamboni’s Research and Results

Dr. Zamboni’s study suggests that iron deposits associated with MS are the result of chronic insufficient venous drainage (high venous pressure), created by blockage of the vessels that drain blood from the brain (Singh & Zamboni, 2009). Iron has been deeply linked with senile toxicity and neurodegenerative disorders. Iron’s redox capability of switching between its ferrous and ferric states (its two ions forms: Fe²⁺ and Fe³⁺) creates dangerous catalytic elements, which lead to neurodegeneration (Singh & Zamboni, 2009). He suggests that after vessels are damaged by

iron, they “leak” the iron and other unwanted cells into the brain through the blood-brain barrier – the barrier between blood and the cerebrospinal fluid (Crowley, 2010). Dr. Zamboni theorized that immune system cells, along with the iron, enter the brain (through the damaged vessels) and trigger neuron demyelination (the destruction of the

fatty sheaths along axons of neurons). This enables debilitating symptoms associated with MS, some of which were mentioned previously in this review. His breakthrough theory is that the blockage in the vessels may be eliminated by means of an angioplasty. This procedure consists of the insertion of a catheter into the patient’s obstructed blood vessel, which has an inflatable balloon utilized to expand the blood vessels. This therapy substantially relieves venous pressure, reducing the damage to the myelin and alleviating the MS symptoms. Angioplasty procedures have long been applied to the treatment for atherosclerosis, which causes narrowing of arteries due to plaque build up (McPhee, Papadakis, & Tierney, 2001). However, Dr. Zamboni is the first to adapt the procedure to MS cases. In one of his trials, where 65 patients were given the treatment, there was a drop in the rate of occurrence of lesions, from 50% to 12% in patients (Zamboni et al., 2009). The study also indicated that the treatment had significantly decreased MS symptoms in certain patients. This was especially evident in MS patients who are prone to relapses (remitting relapsing MS). In this group, there was an increase from 27% to 50% of patients who were relapse-free after the procedure (Zamboni et al., 2009). There was an improvement in mental and physical quality of life for most of the patients in this study, especially the patients who presented primary progressive and relapsing remitting multiple sclerosis (Zamboni et al., 2009). Potential improvements in patients depend on how long they have had MS and how much brain damage had already occurred. Neurons do not regenerate once they are lost and myelin that has been severely damaged may remain scarred, which means that only partial recovery of function may be experienced by patients whom have had considerable neurodegeneration. Ideally, the procedure proposed by Dr. Zamboni would be performed early in the diagnosis, that is, before any significant neurodegeneration occurs in a patient, this way the potential to reduce symptoms associated with MS can be maximized.

Quality of life, well being and the “zone of maximum performance potential”

The competence-press model, which deals with an individual’s performance, was introduced by Lawton in 1970. According to Lawton, there is an ideal equilibrium between competence and press, which must be maintained in order for individuals to function at an optimum level. Lawton named this zone of balance in the model the “Zone of maximum performance potential” (“Key Concepts and Issues”, 2010). One defines “press” from this model, as any kind of obstacle or difficulty, which may be environmental, physical, emotional, occupational, and so forth. Symptoms are perhaps the biggest “press” that patients experience. In the case of MS, neuron degeneration causes blurred vision, muscle weakness, involuntary contraction of muscles, loss of co-ordination, and various other physical and cognitive symptoms which create impediments for individuals afflicted by this disorder (McPhee, Papadakis, & Tierney, 2001). As predicted by the model, symptoms faced by MS patients generate stress, or physical and/ or emotional press on the individual (“Key Concepts and Issues”, 2010). The new procedure proposed by Dr. Zamboni may lessen, if not eliminate, the debilitating symptoms MS patients struggle with. According to Lawton’s model, once the press that the symptoms create for the patient decreases, the individual becomes closer to the “zone of maximum performance potential”. This zone, as the name suggests, is where the person is theoretically able to perform at his/her full potential. Dr. Zamboni’s procedure allows for the patients to enter the zone of maximum performance and potential by relieving them of their symptoms.

The model “Conceptual framework for relating technology to improvement in quality of life and well-being” proposed by Jutai *et al* in 2009, depicts the diverse classifications of technology and their role of in improving quality of life (QOL) and well being. Technology is divided into medical and assistive technologies. Medical technology, also called life support technology, consists of substitutes for body structure or function, medical treatment, and measurement of living body functions. Assistive technology is divided into living support and social activity support technologies. The former consists of self and care support, while the latter consists of vocational and leisure support. This model enables patients dealing with stressful circumstances to educate themselves on techniques, which diminish strain, leading to a better quality of life. Consequently, an individual with a disability who passes from the medical to the assistive technologies his/ her QOL and well being

potentially increases, as according to this model. Dr. Zamboni's procedure may well be considered part of the medical treatment in the medical technology aspect of the model. Individual with MS may obtain Dr. Zamboni's procedure and retrieve body functions lost due to the disorder. Subsequent to body function restoration, the patient can seek self or care support to return to normal activities; and ultimately attain leisure or vocational support, so that he/she may participate in society more effectively and pleasurable, than otherwise possible ("Assistive Devices", 2010). Dr. Zamboni's procedure is perhaps the first significant stepping stone into the improvement of QOL and the well-being for MS patients. As the model by Jutai *et al* illustrates, as function and independence are regained, the patient's QOL and well being increases.

Ethical Issues are Raised

Western Medicine has incessantly progressed alongside technology. They have an important inter-reliant relationship in the western health care model. This dependence is a distinguishing feature of modern-western medicine, which separates it from medicine that is practiced in third world countries. For instance, North American doctors use nuclear imaging studies to diagnose tuberculosis, while World Health Organization (WHO) doctors working in Africa, use solely a stethoscope to reach the same diagnosis. North American health care relies on drugs, medical devices, and diagnostic and surgical equipment, amongst other types of technology, to deliver its services to the general public ("Key Concepts and Issues", 2010). There seems to be an insistent demand for innovations that might enhance or prolong life. Governments across nations spend millions of dollars in funding researchers undertaking the struggle to conjure the next "miracle drug" that will cure the deadliest diseases known. Many will fail in doing so, giving rise to an ethical issue. It may be said that the money used to fund researches would be more wisely spent if it were directed towards the creation of a greater accessibility to treatments of diseases, such as MS, to a greater number of people, perhaps in the form of more comprehensive health insurance coverage over the cost of treatment. Statistics Canada presents the average income of a family with 2 people or more, in 2007 in Canada, as \$71 900, whereas the annual treatment cost for MS, according to the MS society of Canada, is as much as \$40 000 (MS Society of Canada, n.d.).

Ethics is an essential factor when evaluating a new medical technology, as advancing technologies frequently result in moral debates. As previously discussed, Dr. Zamboni proposes that MS is instigated by the narrowing or partial blockage of blood vessels; causing an increase in pressure, and/or backflow of blood in these vessels, allowing unwanted materials to enter the brain and create damage (Singh & Zamboni, 2009). The narrowing of the vessels may be congenital to some people - the hereditary factor of MS. If Dr. Zamboni's theories are proven correct and there is an inherited basis to MS, government health legislators and health care providers will face numerous ethical questions relating to those that may be afflicted. Consequently, the government will be responsible for questions such as: whether there should be screenings for MS? Who should receive such screenings? Are they to be mandatory and free, or optional and not covered by health care plans? Will surgery be the only option for a positive screening test?

The MS society of Canada recognizes the breakthrough that Dr. Zamboni has accomplished; however, it is considered too hastily to reclassify MS as a vascular condition instantly, and so notifications to the public are made concerning follow-up research that must be completed in order for concrete conclusions to be made (MS Society of Canada, n.d.). Referring to the Medical Industrial Complex (MIC), where the state fosters and regulates private corporate interests in health ("Corporate Health and Regulation", 2010), one may reflect that Dr. Zamboni's new technique in treating MS does not follow the financial wishes of private health corporations. Considering that in 2006, 55 000 to 75 000 Canadians were estimated to suffer from MS (MS Society of Canada, n.d.), and that the annual cost for the MS treatment may strike \$40,000, one may conclude that the drug companies world-wide, especially in Canada being one of the largest populations affected by MS - may not regard Dr. Zamboni's procedure as a scientific advance, but rather an economic nightmare. The MIC may include the numerous drug companies, who could potentially lose considerable amount of money annually if the treatment of MS was no longer needed.

Conclusion

In summary, MS has many underlying factors, which must be exhaustively researched in order for concrete conclusions to be drawn. Ethical guidelines ought to be determined when dealing with a discovery of this magnitude,

allowing for the appropriate issues to be questioned, and dealt with. Furthermore, if one considers the money that is generated by pharmaceutical companies dealing with MS treatments, it can be said that Dr. Zamboni might not only be fighting the disease, his recent discoveries may need to stand against corporate greed as well. Ultimately, researchers around the world will have the challenge of testing Paolo Zamboni's theory with an ample number of MS patients in order to validate this new treatment method. If it becomes scientifically proven and accepted by medical societies as a promising way to decrease symptoms, or a definite way to end the disease, this would most certainly revolutionize modern medicine. Such advancements will save potentially millions of lives, inspire innovative researchers to discover treatments, and review existing practices concerning illnesses that are presently considered "death sentences", due to the lack of a cure, or inadequate treatments that only subside symptoms. Future discoveries and pioneer techniques may greatly contribute to solving conditions, such as, Multiple Sclerosis, Lou Gehrig's Disease (also known as ALS), Muscular Dystrophy, Huntington's Chorea, and many others which currently lack a cure or effective treatment to prolong life.

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