Occupational physician and amyotrophic lateral sclerosis: needs and training and information tools

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Abstract

***Introduction*: Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease. The etiology and pathogenesis of ALS are currently largely unknown and the correlation between occupational and environmental exposures and ALS is not clear. The aim of this article is to create an information/training tools not only for workers but also for employers and occupational physicians.**
***Materials and methods*: within the project "Amyotrophic Lateral Sclerosis: contributory causes of occupational origin, risk assessment, early diagnosis and information-education" funded by INAIL, starting from the first year of the research, in parallel with the acquisition of the literature related to the research performed on Amyotrophic Lateral Sclerosis, contributing factors regarding work origin, it was decided to search for informative-educational material produced by the main international agencies and the main associations national and international patients members of the International Alliance ALS/MND Associations. All work tools are designed using the power point without animations for argument gravity.**
***Results*: brochures for occupational physician, employers and workers are created in order to understand the problems of the person with ALS and to maximize the potential workforce.**
***Discussion*: occupational physicians have to know all aspects of ALS in order to improve make a judgment of suitability appropriate for the employee/patient. Employers must know the aspects of the disease, especially from the organizational point of view in order to be prepared in this situation.**
Workers, intended as patients, have to know the disease and know how to deal with it in all possible situations. The psychological aspect has great importance and affects anyone who happens to live new and difficult situations such as ALS.

KEY WORDS: Amyotrophic Lateral Sclerosis, employer, occupational medicine, worker.

Introduction

Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease that affects motor neurons, ie nerve cells both at the cortical level (I° motoneuron) that the spinal cord (II° motoneuron) which control the movement of muscles. The death of motor neurons impairs the function of skeletal muscle, causing paralysis and muscle atrophy. The disorders vary depending on the part of the SN (nervous system) affected. Often, the lack of strength is the first symptom that can manifest itself with fatigue, weakness of the upper or lower extremities, dysarthria and dysphagia (1).
The Amyotrophic Lateral Sclerosis frequently affects males and usually occurs between 50 and 60 years. The annual incidence is 1.7 cases per 100,000 inhabitants. The outcome of Amyotrophic Lateral Sclerosis is always fatal, for an average period of 2-3 years. The 90% of the cases belongs to the sporadic form of the disease (sSLA) and the remaining 10% of cases is familiar form (fSLA) that is transmitted with an autosomal dominant fashion with high penetrance and expressivity or penetrance variables. Clinically fSLA is similar to the sporadic form but the debut of the lower limbs is more frequent and mental deterioration is present in 15% of cases. There is a specific diagnostic test for Amyotrophic Lateral Sclerosis and its course is variable depending on the shape, spinal or bulbar. In some cases it is very rapid with a progressive loss of independence caused by sudden worsening of symptoms requiring decisions and sometimes irreversible

treatments such as tracheostomy and PEG. There is no specific treatment, but a whole series of measures to improve these patients' quality of life: riluzole is the treatment better able to slow the progression, symptomatic therapies for the treatment of drooling, the cramps, pain, insomnia, principals and aids to encourage the remaining time. Not least is to be considered the psychological impact of the disease not only for patients but also for their families (1).

The etiology and pathogenesis of Amyotrophic Lateral Sclerosis are currently largely unknown. Molecular studies focus the importance of genetic factors (2), in association with environmental factors (trauma, intense physical activity, chemicals, electric shock, heavy metals, infectious agents, etc.) in activation of the disease process (3).

Environmental factors such as exposure to toxic agents, such as heavy metals, pesticides, chemical solvents and chronic poisoning by lead, selenium, mercury and manganese (4-6), exposure to fields electromagnetic EMF (7) can also concur to the onset of Amyotrophic Lateral Sclerosis, but at the present time it is not possible to establish any definitive causal link.

Although some neurotoxic effects have been known for a long time, their role in neurodegeneration and in neurodegenerative diseases was understood recently. Studies in literature on the relationship between occupational and environmental exposures, and Amyotrophic Lateral Sclerosis are various and range from clinical or occupational case reports to case control studies, retrospective cohort studies and prospective, based on clinical data and death certificates and do not allow at the moment definitive conclusions (1, 8, 9).

Exposure to pesticides has been assessed in several case-control studies (10-16) and in a cohort study (17); the exposure is generally associated with an increased risk in case-control studies, although the relationship was not always statistically significant.

Kamel et al. (18) conducted a meta-analytic study about studies regarding the association between Amyotrophic Lateral Sclerosis and pesticides as a group of substances and investigated the association ALS-individual pesticides using the data of Agricultural Health Study (AHS). Meta-analytic study showed the association between Amyotrophic Lateral Sclerosis and pesticides as a group; according to AHS, the Amyotrophic Lateral Sclerosis was not associated to pesticides as a group but showed associations with organochlorine insecticides (OCs) (OR 1.6, 95% CI 0.8-3.5), pyrethroids (OR 1.4, 95% CI 0.6-3.4), herbicides (OR 1.6, 95% CI 0.7-3.7) and fumigants (OR 1.8, 95% CI 0.8-3.9).The ORs were also high for individual pesticides aldrin (OR 2.1, 95% CI 0.8-5.1), dieldrin (OR 2.6, 95% CI 0.9-7.3), DDT (OR 2.1, 095% CI.9-5.0) and toxaphene (OR 2.0, 95% CI 0.8-4.9), although none of the associations was significant.

The organophosphates are widely used in agriculture and for some household and alone account for half of the total quantity of pesticides used annually in the US. Exposure to organophosphate has taken a particular relevance due to the report of a Amyotrophic Lateral Sclerosis increased incidence among veterans of the Gulf War (19). Till now, no conclusive evidence is emerged in order to explain this apparent increased risk for Amyotrophic Lateral Sclerosis: however veterans had received a prophylactic treatment containing cholinergic inhibitors to combat the effects of nerve agents. It has been suggested that these pre-treatment may have exacerbated an underlying genetic polymorphism or have unmasked other factors that increase the risk of motor neuron death.

As evidenced by Merwin et al. (20), numerous studies investigated the relationship between exposure to organophosphate and Amyotrophic Lateral Sclerosis examining the relationship with the genes of paraoxonase. The paraoxonase is an A-esterase can detoxify paraoxon, considered the prototype of the organophosphate. The paraoxonase has several variants: PON1, PON2 and PON3. It is hypothesized that the risk of developing Amyotrophic Lateral Sclerosis is correlated to the increase of the mutations of the PON1 gene, in particular if the bodily concentration of PON1 is suboptimal. This assumption stems from the fact that the PON1 hydrolyzes organophosphates and its detoxifying capacity is largely determined by its different variants (21).

For example, genetic variations have been identified in the coding and promoter region of the human PON1 locus which determines the catalytic activity and enzyme levels. Therefore, mutations that impair the ability of detoxifying PON1 may increase patient's susceptibility to organophosphate and potentially lead to the development of Amyotrophic Lateral Sclerosis (22). However, epidemiological and animal studies have not been able to establish a causal link between exposure to organophosphate and mutations in PON1 gene.

The non-ionizing radiation, particularly the electrical and magnetic fields, have been considered as a risk factor for Amyotrophic Lateral Sclerosis (23). Some epidemiological studies suggested an increased risk of neurodegenerative diseases in people occupationally exposed to electromagnetic fields at very low frequency (ELF: 50-60 Hz). Some Danish and US cohort studies had reported greater SLA risk among employees of power companies exposed to electromagnetic fields (24-26), while a Sweden clinical study had found high Amyotrophic Lateral Sclerosis risk among individuals with the highest exposure to magnetic fields (27). Among the possible mechanisms of action of ELF fields are reported alterations of the epiphyseal of melatonin synthesis, alteration of cell membrane permeability and consequent alteration of the flow of biologically important ions changes, in particular Ca^{2+}, in the immune system.

More recently Koeman et al. (7), have shown a strong association between occupational exposure to ELF-MF and Amyotrophic Lateral Sclerosis mortality among men.

The metals such as lead (Pb) and mercury (Hg) are certainly neurotoxic: exposure to high levels of lead is associated with the development of encephalopathy

and peripheral neuropathy and are reported some cases of a syndrome induced by Pb and similar to the MND (28). Lead, cadmium and mercury have been implicated in the etiology of Amyotrophic Lateral Sclerosis as a result of epidemiological and toxicological observations (4, 29, 30), but the association between occupational exposure and ALS has never been clearly demonstrated (31).

Data in the literature do not agree, compared with studies supporting the relationship between metal exposure and Amyotrophic Lateral Sclerosis (32-34) and there are others that don't confirm report. Recently, Vinceti et al. (35) have not confirmed the association between Amyotrophic Lateral Sclerosis and exposure to lead, cadmium and mercury.

Fang et al. (36) have evaluated that in US veterans with Amyotrophic Lateral Sclerosis blood lead levels were higher than controls and suggested the association between high levels of lead in the blood and increased risk of Amyotrophic Lateral Sclerosis. For Pamphlet et al. (37) the exposure to the metal in men is associated with the development of Amyotrophic Lateral Sclerosis while among female workers this association is not confirmed.

Kamel et al. (38) showed that a shorter survival from diagnosis to death showed a weak inverse association with blood lead and a stronger inverse association with Pb bone suggesting that exposure to lead is associated with a longer survival long in cases of Amyotrophic Lateral Sclerosis. These data contrast with the previous findings of lead exposure associated with increased risk of Amyotrophic Lateral Sclerosis. This result, apparently paradoxical, can have a biological explanation: in a recent study of hereditary ALS mouse model have suggested that the onset of the disease is related to motor neuron function, while the progression is regulated by the neuroglia. It's possible that the two processes respond differently to a neurotoxic. Barbeito et al. (39) suggested that exposure to lead can cause activation of astrocytes by inducing an increasing accumulation with relative production of antioxidants that would provide to protect neuronal cells. The Pb could therefore damage the motor neurons and stimulate glial cells to provide trophic support to neurons and thus delaying cell death. The results should be interpreted with caution, because of the unexpected nature of the research and the small size of the study, and must be verified in larger studies.

The neurotoxicity of mercury in humans is well documented (40) but few studies in the literature have suggested the possibility of a link between exposure to Hg and Amyotrophic Lateral Sclerosis and data are not unique: in addition to studies showing an association between exposure to mercury and development of Amyotrophic Lateral Sclerosis (41) do not report other associations (42, 43). According to Johnson and Atchison (4) chronic exposure to low levels of methylmercury in mutant mice overexpressing mutant human SOD1 gene (TGN SOD1G93A) accelerates the development time of the Amyotrophic Lateral Sclerosis phenotype. This suggests that if an individual has a basic genetic polymorphism for Amyotrophic Lateral Sclerosis, the exposure to a toxic metal such as methylmercury could accelerate the onset of the disease. However, a cause-effect relationship between exposure to Hg and Amyotrophic Lateral Sclerosis has never been demonstrated.

Also for aluminum, it was initially assumed a role in Amyotrophic Lateral Sclerosis, but has not been confirmed in more recent studies (44).

Studies about other metals, including selenium (Se), zinc (Zn), copper (Cu) and manganese (Mn), have predominantly evaluated by high exposures toxic effects (45-47).

Kapaki et al. (48) found in Amyotrophic Lateral Sclerosis patients a significant reduction of copper in serum and CSF levels compared to the control group (20.25 ± 7.09 *vs* 30.86 ± 16.02 SD micrograms/l, and 913.21 ± 165.55 against 1020.17 ± 197.76 micrograms/l), and an increase in serum levels of manganese (3.59 ± 0.89 SD micrograms/l *vs* 3:03 ± 1:23 SD micrograms/l) supposing an imbalance in the homeostasis of essential trace elements in ALS patients. Recent studies suggested that copper deficiency can play a role in Amyotrophic Lateral Sclerosis.

Deficiencies of essential trace elements could also conceivably increase the risk of Amyotrophic Lateral Sclerosis, given their role as coenzymes and in mitigating oxidative stress and other critical cellular processes (49).

Numerous solvents and other industrial chemicals are neurotoxic, but in neurodegenerative disorders the past exposure to these agents is often difficult to measure and validate. Some case-control studies evaluated the Amyotrophic Lateral Sclerosis risk among those who reported past exposure to anamnestically solvents (11, 14, 16, 50). Morahan and Pamphlett (15) have demonstrated an association between sporadic Amyotrophic Lateral Sclerosis and exposure to solvents (OR = 1.92, 95% CI: 1.26-2.93) in 179 cases and 179 controls matched for age, ethnicity and gender. In already mentioned study Fang et al. (32), a 60-90% greater risk of developing Amyotrophic Lateral Sclerosis was present in the event of exposure to paint strippers, cutting oils, cooling and lubricants, antifreeze or coolants, turpentine and products for dry cleaning. Specific chemical agents responsible for these associations may include chlorinated aliphatic hydrocarbons, glycols, glycol ethers and hexane. The risk associated with these occupational exposures was greater among non-smokers than smokers. The associations with specific chemicals can also explain the results for certain professions. For example, precision metalworkers are probably exposed to metal particles and cutting, cooling and lubricating oils. Pamphlett (37) found a higher chance of developing Amyotrophic Lateral Sclerosis for exposure to solvents in the workplace, both in men and in women.

Cigarette smoking is the only Amyotrophic Lateral Sclerosis risk factor classified as "probable" in 2003 in an evidence-based review of the literature (52). Over the years they have accumulated more and more evidence linking exposure to cigarette smoke at risk of Amyotrophic Lateral Sclerosis (53-55).

Smoking habits could increase the risk of Amyotrophic Lateral Sclerosis through different mechanisms: strong evidence supports the role of smoking as a cause of oxidative damage, but also the induction of a later neuroinflammation would seem to be a popular theory.

A chronic inflammatory process in the central nervous system (CNS) has been repeatedly suggested as pathophysiological basis of Amyotrophic Lateral Sclerosis. However, regarding the causes of neuroinflammation, a first possibility is that a mutant SOD1 active neurons and microglia, causing tissue damage and thus inducing a vicious circle of inflammation in the CNS. However, SOD1 mutations are present only in 20% of familial cases of Amyotrophic Lateral Sclerosis and are rare in sporadic cases. The hypothesis related to "microglial priming" provides that the microglia, triggered by an existing disease such as degeneration of synapses, axon, cell body or deposition of amyloid, can be stimulated by secondary influences (infection, trauma, environmental exposures) to a state aggressive inflammation, exacerbating neuronal death (56).

As recently reported by Banack et al. (57) cyanobacteria, ubiquitous, produce a series of neurotoxins that bind to targets present in the central and peripheral nervous system and are highly disseminated in terrestrial and marine environments. Although the role of BMAA in neurodegenerative diseases is no clear, it was suggested that this substance is capable of mimicking the glutamate toxicity. The BMAA crosses the blood-brain barrier through the L1 high affinity carrier, but it isn't active until it is associated with the bicarbonate assuming a structure that mimics that of glutamate and activates the glutamate receptors inducing neural death.

The Amyotrophic Lateral Sclerosis has been frequently associated with both heavy physical work that the practice of endurance sports, although to date no scientific certainty has emerged, except for epidemiological research data that remain controversial (55-57).

In 2007, Armon et al. (58) published a critical review is Amyotrophic Lateral Sclerosis physical-activity relationships and concluded that physical activity does not seem to be a risk factor for Amyotrophic Lateral Sclerosis. Even Harwood et al. (59) showed that the evidence that physical activity can be a risk factor for Amyotrophic Lateral Sclerosis were limited and conflicting.

To clarify whether the sport and physical activity increases the risk of developing Amyotrophic Lateral Sclerosis, Hamidou et al. (60) conducted a meta-analytic review of the literature. The results were stratified by type of exposure: 1) physical activity linked to sports and labor (n = 14), 2) Football & Soccer (n = 9), 3) employment (n = 12), 4) other physical activities (n = 2). Among the articles that examined ''physical activity linked to sport and work'', two studies of class I and one of class II concluded that physical activity is a risk factor for Amyotrophic Lateral Sclerosis. The soccer/football game can be considered as possible risk factors for Amyotrophic Lateral Sclerosis but the Authors point to the need further research taking into account the numerous confounding factors and heterogeneity of the studies.

Lacorte et al. (61) conducted a systematic review of Amyotrophic Lateral Sclerosis and physical activity by including in the analysis 19 case-control studies and 7 cohort studies. Also in this study, the evidence related to physical activity as a risk factor for Amyotrophic Lateral Sclerosis does not lead to unambiguous conclusions. However, the Authors point out that the cohort studies report a significantly higher number of cases of Amyotrophic Lateral Sclerosis in professional football and football players and a slightly increased risk of Amyotrophic Lateral Sclerosis in athletes college' teams.

About the pathophysiological mechanisms that may underlie an association, have been hypothesized the excessive production of reactive oxygen species as a result of fatigue, alone or in combination with other determinants (59, 62). A second hypothesis calls into question the glutamatergic excitotoxicity caused by excessive release of glutamate resulting in physical activity (59).

The neurodegenerative disease, and in particular Amyotrophic Lateral Sclerosis, represent a challenge for the physician because of the neighbor and the gradual aging of the working population.

Given the wide variety of factors potentially related to the development of Amyotrophic Lateral Sclerosis and the probable working etiology, it seems important providing to the Occupational Physician tools able to identify suspicious cases to be sent to appropriate diagnostic processes.

The Occupational Physician will also be able to handle any cases in the company always with the aim of protecting the health and safety at work.

The information/training tools not only for workers but also for the management and general population are numerically deficient. This should be seen from two points of view: by the first one, information and training contribute increased knowledge about the disease and prevention in different labor sectors and, on the other hand, can contribute to a better integration of the employee suffering of Amyotrophic Lateral Sclerosis in its environment working allowing them to not be automatically ejected from the workplace realizing the progressive empowerment advocated in the EU.

Materials and Methods

Within the project "Amyotrophic Lateral Sclerosis: contributory causes of occupational origin, risk assessment, early diagnosis and information-education" funded by INAIL, starting from the first year of the research, in parallel with the acquisition of the literature related to the research (epidemiological, clinical, experimental, etc.) performed on Amyotrophic Lateral Sclerosis contributing factors regarding work origin, it was decided to search for informative-educational material produced by the main international agencies *(*NIOSH, OSHA-USA, OSHA-EU, CCOHS, HSE) and the main associations national and international patients members of the International Alliance ALS/MND Associations.

There were found 100 pamphlets, publications and audiovisual material in PPT format and PPTx.
After careful reading of the material there is provided for the processing of:

- an educational brochure dedicated to Occupational Physicians
- an educational brochure dedicated to the workers, management and eventually used for the general population
- an educational brochure dedicated to the employers/managers
- one multimedia visual tool to be used for the workers' information.

All work tools are designed using the power point without animations for argument gravity.

Results

Occupational Physician

The philosophy of occupational medicine was based almost exclusively on the interest for years for occupational etiology of diseases such as pneumoconiosis, noise hearing loss, chronic poisoning by metals and solvents and the role of the occupational hazards in the genesis and development of diseases chronic-degenerative multifactorial etiology.
From the late nineties, however, the European and national policies aimed to prolong working life, have increased the employment rate for people aged between 55 and 64 years from 36.9% in 2000 to 46% in 2009 (EU -27).
The occupational physician, also in relation to the recent evolution of the Italian pension system, in the future years will have to deal with unusual diseases like neurodegenerative disorders.
Occupational physicians are accustomed to managing middle-aged workers and their health problems, but they are ready to handle the most frequent diseases in old age for which now lies ahead, not an automatic abandonment of work at diagnosis but a progressive empowerment to allow the maintenance work for the longest period possible.
Health care professionals who deal with chronic and degenerative diseases may play an important role in preventing automatic exit from work at the diagnosis of the disease. They are able to discuss work-related problems and solutions with these patients. The research in occupational medicine is very marginally interested to the non-expulsion of workers from the labor market even in the face of a heavy diagnoses such as ALS/MND.
Starting from the UK and at the request of people with MND emerges a different way of considering the problem: delay as much as possible expulsion from work by a different organization of work and the use of the most effective technological aids. This allows the workers to have more time to plan the future of their loved ones and their end of life and improves worker's quality of life itsself and caregivers.
The occupational physician will have a double challenge: early identification of those suspected cases that can be sent to GPs for further study and confront other workers suffering of a very serious or fatal disease, but that not necessarily want to leave the job immediately. The cooperation between the occupational physician and GPs will have to be closer and more relevant in the future years.
The occupational physician must confront these difficult suitability taking into account the requirement of the Legislative Decree no. 81/2008, but also of the Legislative Decree no. 216/2003, in the transposition of the Directive Directive 2000/78/EC, which established the prohibition of discrimination, underwriting policy and during the term of the employment contract (public and private), based on, among others, the presence of a disability. The phrase "subject to the provisions providing for the job suitability assessments regarding the need for fitness for a particular job" does not relieve an occupational physician by asking what the judgment of (un)suitability is going to be issued, it is linked to bias or refusal to hear the person with whom you are interacting.
An ALS patient that has effectively done its job until the diagnosis, will be able in all likelihood to also perform it later on with the eventual aids and will not automatically become not suitable to the task.
With the progression of the disease, may be taken those prescriptive measures, through organizational and technical modifications allow the maintenance of work.
The worker with Amyotrophic Lateral Sclerosis may ask to the occupational physician to help to communicate to the employer the news of his illness. The employer may ask the occupational physician for clarification on the disease, its development etc. The brochure aim is to provide occupational physicians and general practitioners a tool, informative-training on Amyotrophic Lateral Sclerosis. The purpose is to allow early recognition of symptoms and understanding of the disease with regard to its progression, managing symptoms, the patient's needs and the importance of the interdisciplinary team.

Workers

The diagnosis of ALS is physically, emotionally and financially devastating. In any case, the person with ALS is the same as the day before diagnosis and has the same baggage of skill and experience. The trend of ALS varies from person to person so the sufferers need to ask themselves what to do with their own work. Even family members who take care of the sick person will be taking the same path in relation to the impact of the disease on their work, although the difference of services for the assistance provided by Local Health. After diagnosis, there's no hurry in making decisions for the future; every decision must be considered and planned on the basis of all possible options.
Another issue to consider is when and how you plan

to inform the employer and colleagues about the diagnosis. Firstly, the diagnosis should be communicated to the occupational physician, if present in the company, in order to evaluate with him the fitness to work and the adjustments required in the organization of work and in workplace. The occupational physician can provide help in advising time and opportunity to communicate the diagnosis to the employer, despite the patient's right to confidentiality. It must be considered case by case. Someone prefers to not reveal the disease until the symptoms impact on the work or till they need to fit the business relationship to their needs. However, this lack of information could interfere with work in terms of a misunderstanding of symptoms: speech disorders, weakness and falling may be related to alcohol abuse.

The way to inform the employer and colleagues will depend on relationships that the sick person has with them and the kind of workplace. It may be advisable to take along someone who can help and give answers the sick worker is not sure about. Among other things we must consider all the information the employer has: the occupational physician and GP may find themselves having to answer questions about the disease to the employer.

Communicating the diagnosis to the employer doesn't mean making diagnosis known by everyone. Patient could decide to say to their colleagues all or just a part; we have to consider the fact that if colleagues don't know the diagnosis might interpret some changes in work as preferential treatment. However, if they know the diagnosis they are in a better position to provide support to the person with ALS. The reactions of colleagues are extremely different, ranging from indifference and negative reactions, to offers support and help.

It might be useful to agree with the employer about whether, how and what to talk about the ill with colleagues.

Employer

The employer has to know that the evolution of ALS must be rated case by case. Many symptoms are mild at first. As happens in other disabling conditions, people with ALS manage their symptoms in order to minimize the impact on jobs. In the initial stage it may be required minimal assistance from the Employer or colleagues to effectively meet needs of their job.

Subsequently, in relation to the trend of the disease, the sick worker will need to change the job (shifting on an administrative work) and/or make changes to the site and/or to the organization of work (i.e. remote work).

Then he could consult the occupational physician, if present in the company, to evaluate the most effective measures to apply.

Actually the diagnosis of ALS does not modify the knowledge and expertise of the worker. Considering that the employer invests time and resources in the development of the individual, it is necessary to continue to take the opportunities of this investment.

In the initial phase of ALS, it shouldn't be complicated for most employers to make the appropriate adjustments to satisfy needs of an employee with ALS. The Legislative Decree no. 216/2003 established the prohibition of discrimination, at the time of taking up employment and during the validity of the employment contract (public and private), on the basis of the presence of a disability. An ALS worker who has played profitably its work until the diagnosis of the disease, will probably be able to do it even later, with any necessary aids. It's important to invest in training of management and to consider the worker with ALS a resource and not a burden.

Lots of workers feel anxious about revealing to the employer their condition. It's an employer's interest encouraging its employees to talk about their illness. The presence in the company of a policy that provides guidance about who you have to contact and how to do it, with due respect of privacy, could be an encouragement. Transparent and secure company's policies help workers feeling safer in their condition. People with ALS may feel particularly vulnerable, unsure of their own abilities and not inclined to talk about their future. The role of the employer is to convince them to not take important decisions in such a critical moment. The confidentiality between worker and employer is essential.

If an employee has chosen to share with the employer information about his illness, it does not mean that he want everyone to be aware of it.

It's important to not break that trust. It might be useful to talk with the worker about if and how colleagues may be aware of, and to talk about any requests for worker's support.

Table 1 shows the brochure for the employer.

Multimedia

The Multimedia is intended to make clear to employees what Amyotrophic Lateral Sclerosis is and how should be managed in the short time and over time. Often workers remain detached from diseases and it happens particularly in the case of ALS because it's a mysterious disease, hard to predict. It's very important "to educate and inform" the workers; this is the only way to take initiatives that have as their purpose the health, the prevention and the safety of the workers.

Despite ALS is a so-called "rare disease", is still a possible eventualities, so all the professionals have to know as soon as possible the signs of disease.

As everyone knows, the occupational physician is responsible for the health and safety of workers at the workplace; also the management of all situations that don't necessarily depend on the work itself, as in the case of a worker affected by ALS, concern to the occupational physician. For this reason the occupational physician must use all his skills and all the medical knowledge to be prepared to deal with a few situations. In addict to the trust between the physician and the patient, also the empathetic aspect has a great im-

Table 1 - Brochure for the employer.

The following information is intended to help the employer to understand the problems of the person with ALS in order to maximize the potential workforce.	
What is ALS	Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease of the adult-elderly (age of onset between 50 and 70 years) and is characterized by the progressive degeneration and highly selective upper and lower motor neurons resulting in paralysis of the voluntary muscles and loss of ability to swallow, speak and breathe. The disease is highly variable with a 2-5 year life expectancy with cases with progression lightning (one year) or very long (ten years or more; 20% up to 5 years and 10% up to 10). **ALS is not contagious or infectious.** For more information see Onlus-associations patients and their families.
How could ALS affect the worker's ability to perform his job?	Keep in mind that the ALS trend needs to be evaluated case by case. Many symptoms are mild in the initial phase. As happens in other disabling conditions, people with ALS manage their symptoms in order to minimize the impact on jobs. In the initial stage it may be required minimal assistance from the employer or colleagues to effectively meet the demands of their job. Subsequently, in relation to the trend of the disease, you will need to change the job (shifting on an administrative duty) or make changes to the site or to the organization of work (i.e. remote work). Consult an occupational physician, if present in the company, to evaluate the most efficient measures.
The worker with ALS is a bad investment?	The diagnosis of ALS does not affect the knowledge and expertise of the sick worker. As employer, you may have invested time and resources in the development of the individual. It's appropriate to continue to take the opportunities of this investment. In the initial phase, it should be relatively simple for most employers make the appropriate adjustments that meet the needs of an employee with ALS. Remember that a prescription of the physician is required by law. The Legislative Decree no. 216/2003 established the prohibition of discrimination, at the time of taking up employment and during the validity of the employment contract (public and private), on the basis of a disability. An ALS worker who has done its work profitably until the diagnosis will probably be able to do it even later, with the necessary adjustment. It's important to invest in training of management and to consider the worker with ALS a resource and not a burden.
Communication	Lots of workers feel anxious about revealing to the employer their condition. It's an employer's interest encouraging its employees to talk about their illness. The presence in the company of a policy that provides guidance about who you have to contact and how to do it, with due respect of privacy, could be an encouragement. Transparent and secure company's policies help workers feeling safer in their condition. The way you are informed will depend on relationships that the sick person has with you and the colleagues and on the kind of workplace. It may be advisable to take along someone who can help and give answers the sick worker is not sure about. People with ALS may feel particularly vulnerable, unsure of their own abilities and not inclined to talk about their future. The role of the employer is to convince them not to take important decisions in such a critical moment. The confidentiality between worker and employer is essential. If an employee has chosen to share with the employer information about his illness, it does not mean that he want everyone to be aware of it. It's important to not break that trust. It might be useful to talk with the worker about if and how colleagues may be aware of and to talk about any requests for worker's support.
Onlus-associations patients and their families	AISLA: http://www.aisla.it AssiSLA ONLUS: http://www.assisla.it Associazione Aldo Perini: http://www.associazionealdoperini.it Associazione Fulvio Cimarolli: http://associazionefulviocimarolli.it/cose-la-sla/ Rete Italiana Associazioni SLA: http://retesla.assisla.it/ Centro Dino Ferrari: http://www.centrodinoferrari.com Associazione viva la vita ONLUS: http://www.wlavita.org Apasla: http://web.tiscali.it/slatorino Arisla: http://www.arisla.org/ Associazione IBIS: http://www.associazioneibis.it Associazione Luca Coscioni: http://www.lucacoscioni.it Icomm: http://digilander.libero.it/icomm_2006

portance: the physician has to over-identificate with the patient in the case of a worker suffering from ALS; this could be of great help in the difficult task of the physician in a so delicate and complicated situation.

Also the family has a decisive role in a context of this kind; it is essential not only for the psychological aspect of the patient, but also for an organizational one. A very heavy responsibility both in terms of physical and mental fatigue and in terms of financial commitment concern to the family, so it is necessary guarantee to the families not only social/health and welfare aids, but also a correct relationship and a valid psychological support approach.
Keep in mind that in the case of a worker with the diagnosis of Amyotrophic Lateral Sclerosis, the job remains in any case a great resource not only in terms of commitment to play, but also in terms of social relationships that are decisive for the life itself.

Discussion

Amyotrophic Lateral Sclerosis, as we said many times, remains an extremely dramatic disease with fatal outcome. Our work has tried to illustrate all the features of the disease, from the historical, etiopathogenic, genetic, clinical, therapeutic and psychological points of view.
We focused on the environmental protection and working point of view, because the disease hasn't yet clear and certain evidence on the causes of its origin. We have illustrated all possible work situations, in our view, related to the disease (e.g. pesticides, metals, low-frequency electromagnetic fields, solvents, etc.) searching for possible good answers about the origin of the ALS.
We tried to investigate the cigarette smoke, which, to this days, remains the most likely risk factor for the onset of ALS.
Given that ALS is a multifactorial disease, we tried to evaluate every aspect of it, that's why we focused on genetic point of view of the disease. In fact we know that the genetic aspect of the disease is evolving; today we only know about 60% of the familial forms of ALS. ALS is a rare condition, but we know it's a disease invested in, not only because of its severity and course, but also because it's a disease that affects workers with different occupational hazards. Initially, the ALS was associated in the collective imagination to sport, e.g. some players have been tragically affected by this disease. Now, with continuous information on the research of ALS, there is the awareness that the disease can affect any kind of workers and/or individual and every age group. Our work aims to be a tool for information about a so important disease, especially for the occupational physician, who is the professional figure at closer contact with workers and who knows the reality of the working world in all its aspects.
No less important, in this context, is the employer, which necessarily must know the aspects of the disease, especially for the organizational point of view to avoid being unprepared in this kind of situations.
Finally, we focused on the worker that is the focus in a work context; the worker, intended as patient but also as colleague or as family, has to know the disease and know how to deal with it in all possible situations. In our work we have also highlighted a psychological aspect that has great importance and affects anyone who happens to live new and difficult situations such as ALS: "the fear of ALS is more common than the ALS too".
Our hope is that everyone arrives as early as possible to learn about the causes of the Amyotrophic Lateral Sclerosis and consequently someone is able to find a therapy for the treatment of this disease. The latest encouraging discoveries in genetic research and other sciences are important signals which we glimpse a small glimmer of light because, maybe very soon, we will have the ultimate solution for ALS.

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