Requirements of the authorized examinator physician (AME) for class II: interpretative doubts and suggestions

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Abstract

The purpose of this document is to clarify the requirements that a doctor must have for carrying out the Authorized Examiner (AME) activity for class II workers.
We have consulted the normative sources that indicate the requisite that the authorized physicians must possess and subsequently we have compared the norms, the European Union regulations and the national ones issued by the National Civil Aviation Body (ENAC), as well as the guidelines indicated by the EASA.
Finally, Authors give suggestions that can be given to ENAC regarding the issue of the authorization as AME examiner for class II workers.

KEY WORDS: aeronautical medicine, authorized examiner, class II, occupational medicine, work.

Introduction

Class I workers are those who perform professional flight activities or skydiving instructors; class II includes those engaged in non-professional flight activities or skydiving activities, as well as professional activities other than aircraft piloting (cabin crew, LAPL, remote piloting); finally, for class III workers we mean those workers who carry out air traffic control activities.
With regard to the initial releases, the class I medical certificates are issued by an aeromedical center (AeMC), the class II certificates are issued by an AeMC or an authorized examiner (AME); LAPL medical certificates are issued by AeMC or an AME.
With regard to revalidations and renewals, the class I and II medical certificates are revalidated or renewed by an AeMC or an AME; the same applies to LAPL medical certificates.
The purpose of this document is to clarify the requirements that a doctor must have for carrying out the Authorized Examiner (AME) activity for class II workers.

Materials and methods

We have consulted the normative sources that indicate the requisite that the authorized physicians must possess and subsequently we have compared the norms, the European Union regulations and the national ones issued by the National Civil Aviation Body (ENAC), as well as the guidelines indicated by the EASA, that is the European Agency for Safety Flight. Below is a list of the standards examined:

- Basic Regulation (EU) n.216/2008 of the Parliament and the Council (1)
- Commission Implementing Regulation (EU) n.1178/2011 of November 3rd 2011 laying down technical requirements and administrative procedures for civil aviation crews pursuant to Parliament Regulation (EC) n. 266/2008 and of the Council (2)
- Regulation (EU) n. 805/2011 (3)
- Implementing Regulation (EU) n.290 /2012 of the Parliament and of the Council, of March 30th 2012, amending Regulation (EU) n. 1178/2011 laying down technical requirements and administrative procedures relating to civil aviation crews pursuant to the regulation (CE) n. 216/2008 of the European Parliament and of the Council (4)
- ENAC Regulations: Health Organization and Medical Certifications of Suitability for Licenses and Aeronautical Certificates - Edition n. 1 of December 21st 2011 (5)
- ENAC Regulations: Health Organization and Medical Certifications of Suitability for Licenses and Aeronautical Certificates - Edition n. 1 Revision of May 17th 2012 (6)

- ENAC Regulations: Health Organization and Medical Certifications of Suitability for Licenses and Aeronautical Certificates - Edition n. 2 of February 24th 2014 (7)
- EASA: Acceptable Means of compliance (AMC) and guidance material (GM) to the MED part of December 15th 2011 (non-binding) (8)
- ENAC Circular: Implementation of the regulation "Healthcare organization and medical certificates of suitability for the attainment of licenses and aeronautical certificates" - MED-01 of December 21st 2012 (9).

Results

The legislation before and after February 24th 2014

According to EU Regulation 1178/2011 (2) the requirements for exercising the profession of AME for class II are as follows:

a. have a degree in medicine and surgery and related qualification
b. have a specialized training course
c. have a basic training course in aeronautical medicine
d. have adequate facilities, procedures, documentation and operational equipment suitable for aeromedical visits
e. demonstrate that you have adopted the procedures and conditions necessary to ensure medical confidentiality.

General practitioners (GMP) are allowed to perform the AME function to issue LAPL medical certificates if they have adequate access to the complete medical documentation of the applicants and in accordance with any additional requirements established under national law; general practitioners who act as AMEs are required to communicate their activity to the competent authority.

Medical specialists in occupational medicine (OHMP) are allowed to perform an aero-medical assessment of cabin crew, if they are qualified to practice medicine and qualified in occupational medicine according to national laws and have acquired knowledge of aeronautical medicine related to the operational context of the cabin crew.

In accordance with the ENAC Regulations: Health Organization and Medical Certifications of Suitability for Licenses and Aeronautical Certificates - Edition 1 of December 21st 2011 (5) the requirements to practice the profession of AME for class II are the following:

a. operate in the national territory
b. possess the degree in medicine and surgery and be qualified to practice freelance
c. be enrolled in the Order of Physicians
d. being a specialist in aeronautical and space medicine, be or have been a medical officer of the Italian Air Force who has carried out this activity for at least 5 years, or have operated at the date of publication of this regulation in the SASN outpatients for at least 5 years as a certified physician of aeronautical psychophysical fitness or having attended and passed a theoretical and practical training course in aeronautical medicine recognized by ENAC. These training courses are differentiated according to the type of certificate that can be issued by the AME
e. have suitable diagnostic tools for carrying out the required specialist exams or be affiliated with a public or private body accredited with the National Health Service.

In accordance with the ENAC Regulations: Health Organization and Medical Certifications of Suitability for Licenses and Aeronautical Certificates - Issue n. 1 Revision of May 17th 2012, the requirements for exercising the profession of AME for class II are the same as those of the aforementioned Regulation (6).

In accordance with the ENAC Regulations: Health Organization and Medical Certifications of Suitability for Licenses and Aeronautical Certificates - Issue n. 2 of February 24th 2014 (7), the AeMC, including IMAS of Italian Air Force and the SASN of the Ministry of Health, and the AME in order to carry out medical examinations including those for the issue of the psychophysical fitness of air traffic controllers, must know the technical requirements and administrative procedures referred to in Annexes IV, VI and VII of the Aircrew Regulation and must be certified.

Pursuant to the ENAC Circular: Implementation of the regulation "Health Organization and Medical Certifications of Eligibility for the Attainment of Licenses and Aeronautical Certificates" - MED-01 of December 21st 2012 the physician who intends to request authorization as AME must be in possession the professional requirements listed in Article 6.1 of the Medical Regulations (9).

Based on the aforementioned, it is possible to identify different formations of the examining physician depending on whether the application for authorization was requested before or after February 24th 2014.

Before February 24th 2014, all those who requested it and have the following title are considered AME class II:

a. specialization in aeronautical and space medicine;
b. medical officer of the Italian Air Force who has carried out this activity for at least 5 years
c. at the date of publication of this regulation (December 21st 2011) at SASN outpatient clinics for at least 5 years as a physician certifying aeronautical fitness
d. having attended and passed a theoretical and practical training course in aeronautical medicine recognized by ENAC.

After February 24th 2014:

a. have a degree in medicine and surgery and related qualification
b. have a specialized training course
c. have a basic training course in aeronautical medicine.

It is evident that in a period prior to February 24th 2014 the so-called "experience gained in the field" was rec-

ognized and a period equivalent to specialization in aeronautical and space medicine was sufficient to be able to obtain the AME title, provided that this activity came carried out at Public Administration or Ministerial Structures.

However, it appears equally evident that other medical professional figures were automatically excluded from this list, i.e. those who served for other Ministries with the presence of an aviation component within it:

a. Medical Officers in Service at State Aeronautical Police Authorities - Ministry of Interior
b. Medical Officers in service at Aeronautical Fire Brigade Bodies - Ministry of Interior
c. Medical Officers in Service at the Aviation of the Aeronautical Finance Police - Ministry of the Treasury, Economics and Finance
d. Medical Officers in service with Authorities of the Port Authorities - Aeronautical Coast Guard - Navy - Ministry of Defense
e. Medical Officers in service at Military Aviation Authorities and Parachuting - Italian Army - Ministry of Defense
f. Medical Officers in service at Aviation and Carabinieri Agencies Parachuting - Carabinieri Corps - Ministry of Defense
g. Physicians qualified to practice the profession who work for Aviation Authorities of the Civil Protection Department.

Finally, it is clear that for applications submitted before February 24th 2014, it was sufficient to participate and achieve a theoretical and practical training course in aeronautical medicine recognized by ENAC, not specifying either the duration of the course itself or the nature of the Organizing Body of the Course, that is, whether public or private, and whether carried out in the university or not.

For applications for recognition as AME submitted after February 24th 2014, the main requirements are those of the specialized training course and that of obtaining a basic training course in aeronautical medicine.

Specialist training course

Regarding the requirement of "specialist training course", any type of medical specialization is included, independently of the affinity with aeronautical medicine (for example, the specialization in pediatrics, pathological anatomy, just to name a few).

It would however limit this activity to those who have the following specialization:

a. aeronautical and space medicine
b. occupational medicine
c. diseases of the cardiovascular system
d. diseases of the endocrine system
e. internal medicine
f. neurology
g. psychiatry
h. clinical and forensic toxicology
i. nephrology
j. urology
k. hematology
l. oncology
m. infectious and tropical diseases
n. orthopedics
o. radiology
p. gastroenterology
q. gynecology and obstetrics
r. dermatology
s. otolaryngology
t. ophthalmology
u. maxillofacial surgery
v. dentistry
w. legal medicine
x. hygiene after obtaining a qualified medical qualification
y. physician already qualified to practice, subsequently graduated in dentistry and dental prosthetics.

Other specialist training courses

Regarding the requirement of the specialized training course, however, all those who also gained the following title would be excluded:

a. Degree in dentistry and dental prosthesis (for those who have already graduated in medicine and surgery and have already been qualified)
b. General medicine training course (GMP) for those who have qualified after December 31st 1994
c. Research Doctorate
d. 2nd Level Master's degree
e. Advanced course
f. Enabling Course in Aesthetic Medicine
g. Technical Application Course for the exercise of the profession of Medical Officer
h. Occupational physician in Occupational Medicine, non-specialist (i.e. those who exercise the teaching or are healed in accordance with Legislative Decree 277/1991 or Ministerial Physicians who exercise this activity in favor of their Administration).

It would therefore be advisable for ENAC to approve the validity of the following courses in this regard:

- Degree in dentistry and dental prosthesis
- Training course in general medicine (GMP)
- Research Doctorate
- 2nd Level University Master
- Advanced course
- Enabling Course in Aesthetic Medicine
- Technical Application Course for practicing as a Medical Officer.

The basic training course in aeronautical medicine

Starting from February 24th 2014, the third of the requisites required is to have obtained a basic training course in aeronautical medicine; respect to the past, however, the ENAC validation is no longer specified, therefore it is sufficient that any University or private institution, authorized by the Ministry to carry out training, organizes a training course in basic aeronautical medicine.

GMP and OHMP

Finally, it is appropriate to focus on the figures of general practitioner (GMP) and the Occupational Physician in Occupational Medicine (OHMP).

As previously written, to general practitioners (GMP) was allowed by the Commission Implementing Regulation (EU) n.1178/2011 of November 3rd 2011 (2), which establishes the technical requirements and administrative procedures relating to aviation crews in accordance with Regulation (EC) n. 266/2008 of the Parliament and of the Council Regulation (EU) n. 805/2011 (3), the possibility of performing the role of AME for the issuance of LAPL medical certificates, provided that:

1. have adequate access to the complete medical records of the applicants
2. provided everything is done in accordance with any additional requirements established under national law.

However, ENAC announced its intention to exclude this professional figure by motivating this decision because point 1 above was not respected. It would have been enough to organize a communication system to remedy this decision:

a. Preparation of a pre-printed certificate along the lines of the anamnestic to obtain the suitability to drive the vehicles with the appropriate modifications, to be filled in to the GMP indicating in the certificate how long the physician had in charge of the patient (Table 1)
b. Communication by ENAC of the minimum observation period to consider this certificate valid
c. Delegate AeMC the visit if the minimum observation period is not observed. With regard to this figure, it is important to remember that the specific training course in General Medicine in Italy was established by law 30/07/1990 n. 212, implementing Directive n. 86/4/CEE. In some aspects this course is compared to that conferred by special-

Table 1 - Example of anamnestic certificate for the GMP for the issuance of LAPL certificates.

I certify on the basis of medical history and clinical data in my possession that Mr./Mrs.
_____
Fiscale Code: _____
in my care since __/__/____ presents/does not present (delete the entry that does not affect) past or current medical conditions with respect to:

ORGANS AND SYSTEMS	YES*	NO
Cardio-circulatory system:	yes	no
Diabetes mellitus	yes	no
Endocrine and metabolic system:	yes	no
Neurological system:	yes	no
Psychological disorders:	yes	no
Epilepsy:	yes	no
Conditions of dependence on alcohol/drugs	yes	no
Conditions of occasional use of alcohol/drugs	yes	no
Urogenital system:	yes	no
Blood and hematopoietic organs:	yes	no
Musculoskeletal system:	yes	no
Sense organs: visual pathologies	yes	no
Blood pressure in pharmacological treatment:	yes	no
Respiratory system:	yes	no
Digestive system:	yes	no
Infectious diseases:	yes	no
Obstetrics and Gynecology:	yes	no
Otolaryngology apparatus:	yes	no
Skin system:	yes	no
Dental pathologies or bad occlusion:	yes	no
Neoplastic diseases:	yes	no

*If so, specify in diagnosis
Date _____
Certification valid for flight purposes for class II if the patient is on the date of issue of the following certificate under the care of the general practitioner for at least __ years

Signature of the interested party

Stamp of the General Practitioner

ization diplomas, as defined by the Legislative Decree August 17th 1999 n. 368, issued in implementation of Directive 93/16/CEE on the free movement of physician and mutual recognition of their diplomas, certificates and other qualifications. The aforementioned legislative decree, in fact, has transformed the training certificate into "Diploma of specific training in general medicine". However, notwithstanding the provisions of art. 21 of the law 368/99, physicians qualified for professional practice by 31/12/1994 have the right to exercise their professional activity as General Practitioners.

Therefore, it should be underlined that the GMP in Italy may not have achieved the training course in General Medicine, especially if it was enabled before December 31st 1994.

It would be important if the ENAC, especially on the figure of the GMP, issued a communication specifying if all the GMPs, after obtaining a basic training course in aeronautical medicine can carry out the activity of AME or only those who have qualified after the December 31st 1994.

As previously written, the aero-medical assessment of the cabin crew would have been allowed to perform to the specialist in occupational medicine (OHMP) if:

1. were qualified to practice medicine
2. qualified as occupational physician under national laws
3. they had acquired knowledge of aeronautical medicine related to the operating environment of the cabin crew.

Even in this case, however, the requirement of specialist training would be lost, as per Article 38 of the TU. 81/2008 and s.m.i. possesses the requisite of Occupational Physician:

a) specialization in occupational medicine or preventive medicine workers and psychotechnics
b) teaching in occupational medicine or preventive medicine for workers and psychotechnics or in industrial toxicology or in industrial hygiene or in occupational physiology and hygiene or in the work clinic
c) authorization pursuant to Article 55 of the legislative decree August 15th 1991, n. 277
d) specialization in hygiene and preventive medicine or in forensic medicine

d-bis) with exclusive reference to the role of the health of the Armed Forces, including the Carabinieri Force, the State Police and the Finance Police, carrying out medical activities in the labor sector for at least four years.

Therefore, they would be authorized to carry out an aero-medical evaluation of the cabin crew by physicians who do not possess the requisite of specialized training as per paragraphs b, c, and d-bis.

Discussion

Suggestions that can be given to ENAC regarding the issue of the authorization as AME examiner for class II workers are as follows:

a. Restrict to the specializations indicated above the possibility of achieving the qualification of AME
b. Make a note, clarifying the validity of the following professional titles:
   - Degree in dentistry and dental prosthesis (for those who have already graduated in medicine and surgery and have already been qualified)
   - Training course in general medicine (GMP) for those who have been admitted after December 31st 1994
   - Research Doctorate in related discipline and possibly specifying the minimum duration
   - II level Master in related discipline and specifying the minimum duration if necessary
   - Postgraduate course in related discipline and specifying the minimum duration if necessary
   - Course qualification in Aesthetic Medicine and specifying eventually the minimum duration
   - Technical Application Course for the exercise of the profession of Medical Officer.
c. Allow the GMP to issue LAPL medical certificates after anamnestic to be sent to the AMS - ENAC Aeromedical Section
d. Making a note on the figure of the GMP, if after obtaining a basic training course in aeronautical medicine, regardless of the qualification date (i.e. even without having completed the training in general medicine) is able to perform the qualification of AME
e. Make a note on the figure of the OHMP, and in particular those who exercise the role of Occupational Physician despite not having achieved the specialization in occupational medicine
f. Make a note about the basic training course in aeronautical medicine, to be considered valid only if recognized in advance by ENAC.

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Pathogenesis of cataract in professional workers exposed to solar radiation in marine environment: clinical-statistical evaluation

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Abstract

In this scientific article, the Author represents the results obtained on two homogeneous populations such as number, age, occupation that involves constant exposure to sunlight and habitat of life, represented by two similar geographical areas for intrinsic and extrinsic risk factors with respect to the pathogenesis of the eye disease in question, the gulf of Pozzuoli (NA) and the gulf of Olbia (OT), both at 40.5 to 41° north latitude both of them on the sea, the first on the european continent and the other on a medium-large island characterized by particular genetic characters for other diseases.

KEY WORDS: cataract, professional workers exposed, intensive solar radiation.

Introduction

Cataracts are currently the leading cause of blindness in the world (about 20 million cases) and the second most prevalent cause of visual impairment (about 81 million cases) (1).
According to ISTAT in Italy, cataracts affect 8.5% of the population between 70 and 74 years, 12.4% in the following five years and 17.1% of those over 80, but there are no reliable data in the youngest population. According to WHO, it is the world's leading cause of blindness and low vision, although it is almost always reversible (2).
The cataract is also responsible for 53% of cases of visual impairment (often it is operable or reversible), mainly concentrated in developing countries, where in many cases there are no resources necessary to carry out the cataract operation (3).
Genetic factors play a role, and in any case the ordinary aging processes of the organism occur, from which obviously even our crystalline lens is exempt (4, 5).
Among the acquired forms of cataracts we recognize senile cataract, which makes up 90% of all forms with onset usually after age 50. Age is the main risk factor, while environmental, metabolic or genetic factors can have a cumulative effect (6).
The senile cataract is distinguished in cortical, nuclear and posterior subcapsular.
Cortical cataracts are the most common form, can be isolated or associated with nuclear opacity, can affect the anterior cortex, the posterior cortex or more frequently both. The main cause involved in its formation is a hydroelectrolytic imbalance that induces hyperhydration and liquefaction of lenticular fibers. Cortical opacities are usually cuneiform and originate from the periphery of the lens with centripetal direction. This type of cataract generates a reduction in the visual acuity of variable entity and a loss of the sensitivity to the contrast that causes glare from bright and intense points of light at night; close vision is also particularly penalized. Diagnosis is performed by slit-lamp biomicroscopy showing cuneiform opacities of generally equatorial origin and in radial arrangement; these signs are better recognizable in backlighting (7, 8).
Nuclear cataract, on the other hand, is due to the opacification of the crystalline nucleus due to the accumulation of insoluble high molecular weight proteins with a consequent increase in nuclear density. This phenomenon, called nuclear sclerosis, initially does not involve a reduction in visual capacity, but generates an increase in the nucleus refractive index with myopicization of the eye, which increases as a result of the evolution of nuclear opacification. The related symptoms are: myopicization with reduction of visual acuity for far and more pronounced in mesopic vision (at sunset), occasionally associated diplopia or monocular polyopia due to a prismatic effect of the different parts of the nucleus. At diagnosis by biomicroscopic examination with direct light beam (by placing the light at 30 and 45°), the loss of transparency of the nucleus with gray-greenish color is evident in the initial phases (initial cataract) and yellow-brown in the advanced

phase (intumescent cataract): when this is also associated with the cortical cataract, it is defined as total (9). The posterior subcapsular cataract usually begins at the posterior pole of the lens in the form of fine granular opacities with the tendency to propagate to the periphery constituting plaque opacity. This type of cataract is very common in diabetic subjects or following prolonged corticosteroid treatment. The impairment of the visus is particularly severe because the site of opacity is very close to the nodal point; consequently there is a difficulty in close vision with daytime glare while in the early stages the night vision is quite good. It is possible the development of monocular diplopia due to localized modifications of the refractive index. At the slit lamp, the posterior subcapsular cataract is highlighted as a dark area by placing the light beam in backlight. On the other hand, in the advanced phase it appears as a thick area like calcification.
In the therapeutic field, cataracts take advantage of an exclusively surgical approach; operability is entrusted to a medical and/or functional criterion. The first one considers the maturational state of the cataract and the risk of associated complications, the second one is based on the decrease of the visual acuity and on the consequent implications in the daily life (10).
The opacification of the crystalline lens can also be acquired in the case of traumatic cataracts secondary to penetrating traumas that generate a continuous solution of the capsule, the metabolic cataract, linked to systemic diseases, such as in galactosemia, Fabry's disease, Lowe's syndrome or oculocerebrorenal syndrome and in Wilson's disease. It is then possible a secondary toxic cataract for prolonged use of topical corticosteroid drugs or for systemic use with formation of a posterior subcapsular cataract, miotic anticholinesterases and phenothiazines which cause star-brownish deposits under the anterior capsule.
The prevalence of senile cataracts associated with visual defect varies from Northern Italy to the South, being higher in the South. The prevalence quotient in the population aged over 40 years is included in the South between 4.7 and 7.2%, with an increase maximum prevalence in the population older than 70 years. Treating in this scientific work exclusively of cataracts acquired in a young population and favored by intense exposure to ultraviolet radiation present in sunlight, we then perform a classification of the acquired cataracts, according to the topographic criterion in:
- nuclear cataracts
- cortical
- posterior and mixed subcapsules.

According to the entity of the density of the opacity of the crystalline cataract is classified in: incipient cataract, intumescent cataract, mature cataract, cataract hypermatura (or morgagnan cataract) and within the latter there is a white-cataract and a brunescens-cataract and a nigra-cataract (11).
Numerous studies highlight the correlation between long-term occupational exposure to solar radiation and the increased risk of developing cataracts, particularly cortical and nuclear (12-14), although further studies would be needed to establish solar exposure levels. Associated with the increased risk of the onset of the disease and, therefore, propose appropriate occupational exposure limits.
The solar radiation is absorbed by different ocular structures causing thermal and photothermal effects; in particular, the UV-A and UV-B rays are absorbed by both the cornea and the crystalline, while the UV-C rays are absorbed by the cornea (13).
It is also emphasized that in the summer season solar radiation is maximum both in terms of intensity and number of hours of irradiation at the Italian latitudes.
In the period between June and July two homogeneous populations of port workers, maritime workers and bathing attendants were selected, which, for the type of their profession, remained for many years (at least ten) under the action of solar rays in the central hours of the day during the period of our interest.
Workers also showed a bilateral natural visus of 5/10 or greater and the anamnestic questioning said they had no eye pathology in the past and used non-graded protective sunglass during their work in a continuous manner (15).
The choice of the two geographical areas in question was dictated by the examination of the international bibliography, according to which during the annual summer season in these areas there is maximum solar irradiation, a situation amplified by the natural reverberation of the sandy surfaces and marines widely represented on the spot (16).
Moreover, the density of the local population, associated with the relative shortage in the area of polluting industrial activities, made it possible to verify whether or not there was a genetic predisposition for the senile and pre-senile cataract in the island population compared to the continental population (17).
The aim of the study was therefore to evaluate the existence of genetic predisposing factors to cataracts in the Sardinian populations professionally exposed to summer solar radiation in the marine environment.

Materials and methods

The two populations of workers studied consisted of 78 subjects of the Pozzuoli group and of 82 subjects of the Olbia group; they were all aged between 36 and 45 years, they were free from defects of refractions, such as myopia, which anticipate the problem of cataracts and other chronic ocular pathologies; they did their work exposed to sunlight for 6-8 hours a day for 6 days a week and were part of the professional categories of fishermen, boatmen and lifeguards.
To all these workers a refractive examination was carried out by means of a Snellen optotype and only those who had a natural visus of at least 5/10 per eye were enrolled at the end of the study.
The subjects also enrolled through a slit-lamp biomicroscope, examined the anterior segment with particular attention to the degree of opacity of the sclerosis crystalline lens.

A classification in three grades was therefore preferred for the important opacities of the crystalline: incipient cataract, intumescent cataract and mature cataract, even if the latter was never found in the sample examined as it is relatively young subjects who also have easy access to services health professionals living in a European country and being periodically examined by an Occupational Physician according to the Legislative Decree n. 81/08 and subsequent amendments (18, 19).

Results

As previously mentioned, no worker examined had an opacity of the lens that could be classified as a mature cataract, even if none of the problems was limited to cases of incipient cataract and to the intumescent and the cohort of Pozzuoli were affected by the type of incipient cataract 138 eyes of 69 people, equal to 88.46% of the sample; for the cohort of Olbia the eyes affected by incipient cataract were 134 of 67 people, equal to 81.70%.

The factors to be highlighted in this study are therefore undoubtedly the bilaterality of the crystalline sclerosis, as obviously no subject was monocle and the numbers show this case; moreover, despite the relative young age of the sample, these subjects had an incidence of progression of the crystalline sclerosis higher than the health statistics for cohorts of the same age, probably due to the constant exposure to sunlight in a highly reflective marine environment.

However, it is emphasized that there were no statistically significant differences between the two groups studied with the Student's T test, so it can be assumed that the specific genetic factors that operate on the island of Sardinia and that for example favor Mediterranean anemia or other congenital or acquired pathologies in the case of the pathogenesis of cataracts do not seem to be important (20, 21).

Discussion

The current literature emphasizes how professional chronic exposure to solar radiation increases the risk of cataract onset, particularly the cortical and nuclear (12-14).

However, as can be seen from the data collected in the present study and described above, no statistically significant factors emerged regarding the existence of genetic predisposing factors to the cataract in the Sardinian populations, stimulated by the technopatic exposure to the intense summer sunlight in the marine environment, an aggravation of the crystalline sclerosis exists if compared to age groups not professionally exposed (22, 23).

The study in question, conducted on two homogeneous populations for visual conditions, age and occupation carried out in the most intense weeks of solar ultraviolet radiation, has not statistically demonstrated the existence in the isolated population of Sardinia of genetic factors able to play a role of a truly melting moment, that is, an efficient and determining contributor, in the pathogenesis of cataract opacity.

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Long-acting (LA) neuroleptics in comparision. A naturalistic and retrospective study on 109 patients of a Mental Health Center

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Abstract

In this naturalistic and retrospective study, we analyzed many variables, 35 specifically, in order to see if and in what percentage patients who make or have made use of SGA have improved their lives in the sense of greater recovery and/or quality of life and if you have reduced the expenditure for admissions, in the sense of the number of total days, both in SPDC and psychiatric structures accredited in the region of Lazio.

KEY WORDS: adherence, compliance, efficacy, cost effectiveness, FGA and SGA Neuroleptics.

Introduction

Current scientific knowledge on and in relation to the use of long-acting neuroleptic antipsychotic drugs (1-6) shows evidence on the overall improvement of patients' clinical conditions, both in terms of compliance and adherence, with a greater possibility of functional recovery, both personal and social of the subjects treated. It is also true that such investigations, like some randomized studies (7, 8), are mostly carried out by comparing patients who take therapy with the same drugs but by oral means, leaving brackets, a whole series of variables that surely can influence research results. Another variable to consider is that linked to future medium and long-term follow-up, where it will be understood if the extrapyramidal effects (9) are really minor and if the metabolic syndrome (10) is not even increasing. The various meta-analyzes (11-13) help us in part to analyze the critical variables, but we think we need to further expand what is already present in the literature to get a more comprehensive picture of the problem.
The main purpose of this work is therefore to want to study and analyze if it is true that the use of "Atypical" Neuroleptics (SGA) compared to the classic first-generation Depot (FGA), is really more effective and that these reduce health care, especially with respect to the use of drugs, in the clinical management of psychotic patients.

Materials and Methods

In order to analyze what has been explained, a grid of and with 35 variables (Table 1), listed below, has been developed *ad hoc*, then analyzed using the Chi Square Test.

Sample

- Sample: consisting of 109 subjects, all with a diagnosis of psychosis
- Gender: F = 41 (37.6%) and M = 68 (62.4%)
- Age: 21-75 (Average 47.6); F 21-75 (Average 50.7); M 21-75 (Average 45.7)
- Observation period: second semester 2014 - all 2015 - first hundred days of 2016, all patients belonging to a Mental Health Center (MHC) in Rome (ex B), with a catchment area of about 250,000 inhabitants
- Enrollment: the first prescription of Depot/LA, between 01.02.1995 and 02.10.2015.

The prescribed drugs were as follows (Table 2):

- ALO-D = 63 (3 switch to PAL-D)
- ARI-D = 3
- FLU-D = 15
- PAL-D = 21 (1 switch to ALO-D)
- RIS-D = 6 (1 switch to PAL-D)
- ZUC-D = 1

The period or time of use is described below:

- <1 year = 23 (21.1%)
- 1-3 years = 35 (32.1%)
- 3-5 years = 23 (21.1%)
- > 5 years = 28 (25.7%)

Statistical significance was calculated with paired samples test (Tables 4-6).
The first data refer to the resources and the latter to the results.
The values are for all referred to the last year compared to the previous year for the resources and final towards the previous year, for the outcomes.

Table 1 - Variables.

1	Gender (M/F)
2	Age
3	General Physician
4	Beginning Of Prescription
5	End Of Prescription
6	Drug
7	Total Milligrams Prescribed In The Period (Including Induction)
8	Previous Drug
9	Reason for the Switch
10	Total Recovery In Spdc 6 Months Before The Period Of Observation
11	Total Recovery's Days In Spdc 6 Months Before The Period Of Observation
12	Total Recovery In Spdc 6 In The Period Of Observation
13	Total Recovery's Days In Spdc 6 In The Period Of Observation
14	Total Recovery In CDC 6 Months Before The Period Of Observation
15	Total Recovery's Days In CDC 6 In The Period Of Observation
16	Visits Of The Psychiatrist 6 Months Before The Period Of Observation
17	Visits Of The Psychiatrist In The Period Of Observation
18	Visits Of The Psychologist 6 Months Before The Period Of Observation
19	Visits Of The Psychologist In The Period Of Observation
20	Visits Of The Nurse 6 Months Before The Period Of Observation
21	Visits Of The Nurse In The Period Of Observation
22	Visits Of The Social Worker 6 Months Before The Period Of Observation
23	Visits Of The Social Worker In The Period Of Observation
24	Other Drugs 6 Months Before The Period Of Observation
25	Other Drugs In The Period Of Observation
26	Initial Global Evaluation Of Operation (VGF)
27	Final Global Evaluation Of Operation (VGF)
28	Initial HoNOS
29	Final HoNOS
30	Initial QTc
31	Final QTc
32	Initial BMI Body Mass Index
33	Final BMI Body Mass Index
34	ESP Extrapyramidal Symptoms (yes/no)
35	PRL Prolactin (yes/no)

Results

From the data collected with the study, with all its limitations, at the moment it does not seem to clearly emerge a significant difference between SGA and FGA. It should be noted that in the sample there were no subjects treated with olanzapine and with perfenazine in depot formulation. The complexity and the heterogeneity of many of the variables analyzed does not allow to evaluate with precision and correctness the efficacy (1) and the cost effectiveness (14) (cost-effectiveness analysis = CEA, method of evaluation of public investment projects) of different neuroleptics. To tell the truth, to look at the numerical results, in terms of statistical significance, particularly for the resources used and studied even more than the outcomes, data seem to emerge slightly in favor of the SGA compared to the FGA. The P-factor, i.e. the probability which represents the significance level of a test, usually has a probability level of 0.05 (5%) or 0.01 (1%). This probability represents a quantitative estimate of the probability or not that the

Table 2 - Drugs' list.

Drugs	Cases
Total Patients	109
ALO	0
ALO-D (haloperidol depot)	60
ALO-D/PAL-D	3
AMI	0
ARI	0
ARI-D (aripiprazole depot)	3
ASE	0
BRO	0
CLOR	0
CLOZ	0
DIP	0
FLU-D (fluphenazine depot)	15
LEVM	0
LEVS	0
OLA	0
OLA-D (olanzapine depot)	0
PAL	0
PAL-D (paliperidone depot)	20
PAL-D/ALO-D	1
PER	0
PER-D (perphenazine depot)	0
PRO	0
QUE	0
RIS	0
RIS-D (risperidone depot)	5
RIS-D/PAL-D	1
TIO	0
TRI	0
ZUC-D (zuclopentixol depot)	1

observed differences are due to chance or not. It's like saying, the risk of misinterpreting the result of the research.
Below is the legend concerning the reasons for the change of drug (switch) (Table 3).
Below are listed the results of the statistical evaluations with the descriptive and meaningful tests of the differences in the use of resources (admissions, visits, etc.) and in the outcomes (scales VGF, HONOS, etc.), plus two non-comparable variables, the Prolactin and extrapyramidal symptoms.

Resources

The admissions data is as follows:
- 25 *vs* 48 (p-value <0.05)
- -47.9%

The days of hospitalization in SPDC (psychiatric service of diagnosis and treatment):
- 304 *vs* 448 (do not sign)
- -32.1%

Inpatient days in the CDC (approved nursing home):
- 267 *vs* 302 (do not sign)
- -11.6%

Psychiatric visits:
- 989 *vs* 1296 (p-value <0.01)
- -23.7%

Psychological visits:
- 242 *vs* 488 (p-value <0.01)
- -49.6%

Nursing visits:
- 558 *vs* 744 (p-value <0.01)
- -25.0%

Social worker visits:
- 163 *vs* 342 (p-value <0.01)
- -52.3%

Outcomes

VGF (global evaluation of operation) mean:
- 45.89 *vs* 43.01 (p-value <0.01)
- +2.9

HoNOS (outcome evaluation scale: Health of the Nation Outcome Scales) media:
- 19.23 *vs* 20.02 (p-value <0.01)
- -0.75

Table 3 - Reason of drugs' switch.

Reason for the switch	Cases
Total	**92**
1 - Poor/Reduced Or No Clinical And/Or Symptomatological Efficacy	41
2 - Comparison Of Important Side Effects	8
3 - Request Of Patient And / Or Of Caregivers, To Improve Compliance	22
4 - Simplification Of The Recruiting Scheme	20
5 - Reduction Of Costs Of Drugs	1
6 - Other	0

Table 4 - Statistics for paired samples.

		Average	N	Standard Deviation (SD)	Standard Error Average
Couple 1	R_SPDC_pre	,4404	109	,87592	,08390
	R_SPDC_post	,2294	109	,42236	,04045
Couple 2	GD_SPDC_pre	4,1101	109	8,70434	,83372
	GD_SPDC_post	2,7890	109	6,14949	,58901
Couple 3	GD_CDC_pre	2,7706	109	8,48051	,81229
	GD_CDC_post	2,4495	109	6,71163	,64286
Couple 4	VIS_PSI_pre	11,8899	109	5,14843	,49313
	VIS_PSI_post	9,0734	109	4,66608	,44693
Couple 5	VIS_PSICO_pre	4,4771	109	5,99938	,57464
	VIS_PSICO_post	2,2202	109	2,82305	,27040
Couple 6	VIS_INF_pre	6,8257	109	7,03542	,67387
	VIS_INF_post	5,1193	109	6,51739	,62425
Couple 7	VIS_AS_pre	3,1376	109	3,32629	,31860
	VIS_AS_post	1,4954	109	1,82890	,17518
Couple 8	VGF_pre	42,8257	109	6,59383	,63157
	VGF_post	45,5596	109	7,57974	,72601
Couple 9	HONOS_pre	19,9450	109	3,48498	,33380
	HONOS_post	19,2385	109	4,48846	,42992
Couple 10	QTc_pre	,3992	109	,04378	,00419
	QTc_post	,4071	109	,04520	,00433
Couple 11	BMI_pre	23,9174	109	4,19684	,40198
	BMI_post	24,5229	109	4,29814	,41169

Table 5 - Correlations for paired samples.

		N	Correlation	Statistical significance
Couple 1	R_SPDC_pre and R_SPDC_post	109	,325	,001
Couple 2	GD_SPDC_pre and GD_SPDC_post	109	,307	,001
Couple 3	GD_CDC_pre and GD_CDC_post	109	,700	,000
Couple 4	VIS_PSI_pre and VIS_PSI_post	109	,659	,000
Couple 5	VIS_PSICO_pre and VIS_PSICO_post	109	,538	,000
Couple 6	VIS_INF_pre and VIS_INF_post	109	,903	,000
Couple 7	VIS_AS_pre and VIS_AS_post	109	,336	,000
Couple 8	VGF_pre and VGF_post	109	,557	,000
Couple 9	HONOS_pre and HONOS_post	109	,859	,000
Couple 10	QTc_pre and QTc_post	109	,640	,000
Couple 11	BMI_pre and BMI_post	109	,920	,000

QTc (value extrapolated from the ECG trace) mean:
• 0.41 *vs* 0.40 (p-value <0.05)
• +0.1

BMI (body mass index) average:
• 24.53 *vs* 23.93 (p-value <0.01)
• +0.6 / + 2.5%

In addition, the data related to other studied variables are also reported, very little assessable by their nature, such as:
• Extrapyramidal symptoms: 40/109
• PRL (prolactin): 14/109

A note of caution we feel at this point to add it to you.

Table 6 - Paired samples test.

		Couple differences					T	Df	Significance (2-tail)
		Average	SD	Standard Error Average	Confidence Interval at 95%				
					Lower	Upper			
Couple 1	R_SPDC_pre - R_SPDC_post	,21101	,83968	,08043	,05159	,37043	2,624	108	,010
Couple 2	GD_SPDC_pre - GD_SPDC_post	1,32110	8,98443	,86055	-,38466	3,02687	1,535	108	,128
Couple 3	GD_CDC_pre - GD_CDC_post	,32110	6,10992	,58522	-,83892	1,48112	,549	108	,584
Couple 4	VIS_PSI_pre - VIS_PSI_post	2,81651	4,07832	,39063	2,04221	3,59081	7,210	108	,000
Couple 5	VIS_PSICO_pre - VIS_PSICO_post	2,25688	5,07244	,48585	1,29384	3,21992	4,645	108	,000
Couple 6	VIS_INF_pre - VIS_INF_post	1,70642	3,03468	,29067	1,13026	2,28258	5,871	108	,000
Couple 7	VIS_AS_pre - VIS_AS_post	1,64220	3,21318	,30777	1,03216	2,25225	5,336	108	,000
Couple 8	VGF_pre - VGF_post	-2,73394	6,72563	,64420	-4,01086	-1,45703	-4,244	108	,000
Couple 9	HONOS_pre - HONOS_post	,70642	2,33056	,22323	,26395	1,14890	3,165	108	,002
Couple 10	QTc_pre - QTc_post	-,00784	,03780	,00362	-,01502	-,00067	-2,167	108	,032
Couple 11	BMI_pre - BMI_post	-,60550	1,70521	,16333	-,92925	-,28176	-3,707	108	,000

Discussion

We can say that perhaps more variables are needed, studied for longer times, with a more selected population of psychotic patients, but even more it would be better to enter the specifics of some variables, such as the number of SPDC and CDC admissions.

There are patients who have been treated with LA (long-acting) for a year and others for much longer: this makes the desired effect "distorted", that is to say underestimated, because it is presumable that patients in therapy for a long time are now "stabilized". As to say that after a long period of stable care, with good compliance and also adherence, the weight that one or the other drug has is reduced; furthermore, it is also obvious that all the other psycho-social variables come into play, which can at least disguise the different value of efficacy (1, 3) of the drugs used, if not actually covered.

On the other hand, doing this statistical evaluation, only on those patients who entered therapy in the last year or three years, would have reduced the whole sample too much.

Therefore, we have preferred to leave the data for what it is, in order to propose it like a possible object of study and reflection, for those who want it, in a future that we hope is coming soon and brings more certain results.

The sustainability of health care expenditure and in particular that for the management and assistance of patients with psychiatric disorders, seems to us more and more timely and not to be underestimated, in order not to have to fight public administrators with subjective and impressionistic opinions, but with real and measurable data.

Only a correct analysis of our daily clinical action will allow us to feel really free to prescribe this or that drug, this or that psychological support or even that rehabilitation, knowing with sufficient certainty that you are doing the best for that person, in that moment and also in the interest of the community.

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Comparison between monitoring procedures in case of radiological/nuclear emergency in civil and military area

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Abstract

The dispersion of radioactive elements in the environmental matrix usually occurs with the release of a cloud of radioactive material followed by the relapse (fallout) on the ground, water or urban environment and then the contamination of plants and the food chain. In the cases of a nuclear and radiological emergency it is therefore possible to highlight three phases: Early phase; Consequence Management; Recovery Phase. The civil and military monitoring procedures are mostly identical starting from the instrumentation used to carry out surveillance and monitoring, therefore it is therefore essential to implement the synergy, still in force, between military and civilian operators in the radiological and/or nuclear emergencies, standardizing as much as possible the procedures for action.

KEY-WORDS: ionizing radiation, levels of dose intervention, monitoring procedures, nuclear emergency, radiological emergency

Introduction

Ionizing radiation (1, 2)

Radioactivity refers to the phenomenon of emission of particles or energy by atomic nuclei that are unstable from the point of view of the energy of binding between nucleons (particles that make up the nuclei). Unstable elements spontaneously tend to achieve stability by emitting corpuscular radiation or electromagnetic radiation. This activity cannot be influenced by either chemical reactions or physical conditions.
The corpuscular radiation can be of three types:

- α radiation, i.e. the emission of two protons and two neutrons
- β - radiation, i.e. the emission of a particle equal to the electrons
- β + radiation, i.e. the emission of positrons.

The nucleus that emits the corpuscular radiation remains in an excited state and in returning to the initial state emits a radiation of pure energy called γ radiation. These radiations are called ionizing because they are able to ionize the matter they pass through or interacting with the matter they have enough energy to tear off electrons to the atomic orbits with the effect of modifying the chemical bonds. The exposure of living matter to ionizing radiation can therefore create damage up to the cellular level or genetic heritage. For this reason, the dispersion into the environment of radioactive material can create a real emergency whose management is particularly delicate.

The phases of nuclear and radiological emergency (3)

The dispersion of radionuclides (radioactive elements) in the environmental matrix usually occurs with the release of a cloud of radioactive material followed by fallout on the ground, water or urban environment and then the contamination of plants and the food chain. In the cases of a nuclear and radiological emergency it is therefore possible to highlight three phases:

a. Early phase or Phase I, in which the release of radioactive substances occurs from the cloud; therefore, the main routes of exposure are external irradiation and inhalation of contaminated air; in the radiological emergency this phase has a duration limited to some hours, in the nuclear one it can reach some days.

The countermeasures that can be taken are the following:

1. rescue of contaminated people
2. control of access to the areas concerned
3. evacuation
4. shelter indoors
5. iodine-prophylaxis
6. restrictions on the consumption of exposed foods
7. protection of grazing livestock

b. Consequence management or Phase II, in which the deposition of radioactive substances occurs on the ground and the subsequent transfer to the environment and foodstuffs, the main routes of exposure are direct irradiation from the material deposited on the ground, resuspension inhalation radioactive substances and the ingestion of contaminated food; this phase can reach a duration of a few weeks.

The following countermeasures can be adopted:

1. restrictions on the production, distribution and consumption of contaminated foods
2. interventions in agriculture and animal husbandry protection
3. evacuation of population from areas with significant levels of contamination for prolonged exposure.

c. Recovery phase or Phase III, which represents the time necessary for the restoration of normal conditions, the main routes of exposure are the ingestion of contaminated food and the irradiation from the soil; this phase can last long periods of time.

The countermeasures that can be used are:

1. definition and implementation of land reclamation interventions
2. carrying out radiological surveillance of the environment and the food chain
3. management and disposal of radioactive waste produced.

Levels of dose intervention (3, 4)

In the monitoring of radioactive substances in an emergency situation, Italian legislation establishes dose intervention levels (LI). Dose means the ratio between the energy absorbed by the body following exposure to ionizing radiation and its mass. The unit of measurement of the dose is Gray (Gy). A Gray is equivalent to one Joule of energy absorbed for each kilogram of mass. The equivalent dose instead represents the product of the dose for a weighting factor that takes into consideration the different dangerousness of the types of radiation (i.e. alpha particles are twenty times more harmful than beta).

The effective dose is given by the product of the equivalent dose for a weighting factor that takes into account the different resistance of human organs to exposure to ionizing radiation (i.e. the skin is ten times more resistant than the lungs). In the initial phase of the emergency the intervention levels are expressed in the following terms:

1. Avoidable dose (expressed in mSv) following the adoption of a single provision (Shelter indoors, Administration of Iodine, Evacuation)
2. Projected dose (expressed in Gy), i.e. the dose absorbed by an individual, in an interval of time from the start of the accident, from any route of exposure and in the absence of protective actions.
3. Effective or equivalent international dose (expressed in mSv), with a range, in which the minimum value indicates the threshold below which protective actions must not be taken, and in which the maximum value indicates the threshold above of which it is mandatory to take protective actions.

In the monitoring of radioactive substances in an emergency situation, in the medium and long-term phase, certain levels of intervention are indicated (LI) which are expressed in terms of effective Dose (expressed in mSv and Sv) at international level, which may involve certain protective actions such as the temporary or definitive removal of population groups, restriction on the production and consumption of food, as well as interventions in the agricultural and zootechnical sector.

Monitoring means surveillance of a radiological or nuclear emergency, followed by sampling and analysis of matrices, indicative of the severity or less of the situation based on the sensitivity expressed in Minimum Detectable Activity (MAR).

These matrices, mostly contained in “Marinelli beakers” of varying size, are subjected to γ-spectrometry in general, assuming Cs-137 as the reference radioisotope to highlight the required MAR (in some cases even the Sr-90 and the Pu).

This spectrometry can be performed on the natural sample (INITIAL Phase) or on a sample suitably treated by drying, evaporation, etc. (Medium-long term phase)

As far as the atmospheric particulate matter is concerned, it will be subjected to alpha and total beta detection.

Military Monitoring Procedures (5)

In the military sphere, the monitoring of a radiological /nuclear emergency is carried out through a field surveillance that can be aerial or earthly.

a. The survey

The detection can be performed by measuring radioactivity values of:

1. Cloud, through which it is possible to evaluate the risk for the population, the levels of β and γ radiation and implement the protective actions
2. Deposition on the ground, through which the levels of contamination suffered by the population and in food can be established
3. Source, to assess the levels of radiation γ in the environment in order both to undertake the protective actions deemed appropriate and to secure the source
4. Contamination, in particular on the soil, to be evaluated by means of a Geiger-Muller counter or sensor with a zinc sulphide scintillator.

b. The analysis

The analysis is carried out by γ *in situ* spectroscopy, performing an estimate of the concentration of contaminants in the field. The spectroscopy systems can be located both on aerial platforms and on ground platforms, which use high and low resolution detection systems, which are connected to computers "onboards" or "laptops" that process the data received from the field.

The use of these systems requires the use of specialized teams with appropriate experience and training.

1. Field methods "on the ground"

Low resolution γ spectrometry is the simplest method available for rapid identification of γ-emitter radioactive materials, thanks to a portable spectrometer with an iodine-sodium or cadmium-zinc-tellurium sensor.

Due to the low resolution, manual spectrometers are not suitable for environments with high γ emissions (formerly nuclear weapon fallouts) and are not routinely used to calculate surface contamination levels.

High resolution γ spectrometry is to be preferred in field measurements when this is possible. It also integrates with global positioning (GPS) and graphic information (GIS) systems, so that large areas can be monitored quickly.

Thanks to the high resolution it is possible to identify with certainty the radionuclides present in the environment; the disadvantage lies in the high cost, complexity and extreme fragility compared to "low resolution" models, not to mention that the demand for liquid nitrogen prevents its use.

For field measurements the sensor is oriented towards the surface, at about one meter to carry out the measurements on the contaminated ground.

These systems allow to accurately identify α emitters such as plutonium, uranium, other X-rays and γ-emitter isotopes in the environmental mean, if a mixed composition of radionuclides is present.

2. Aerial field methods

The easiest application of this type of monitoring was to determine the exact location of the natural uranium reserves. In these methods sodium-iodine detectors on an aircraft system are widely used. In the last forty years, updates of detectors, electronic components, computational algorithms associated with helicopters have increased the ability to quickly identify contaminated regions following nuclear accidents. The biggest limitation of these methods is the sensitivity, as the atmospheric and geometric attenuation reduces the influence of the γ rays on the detectors. However, the merits of these systems include an enlarged view of the field of interest and mobility is given by an aerial platform.

c. Directions to follow in phase I

In the first phase, the immediate one (minutes - hours after accident), it is necessary to assess the threats and nuclear or radiological risks, and plan the mission; if the risk is high, special teams must be alerted and deployed, otherwise it is sufficient to observe and monitor the situation, until the threat is discovered or the accident occurs. If this were to be carried out, it is necessary to take a protective position, by delimiting the contaminated areas from tens of meters up to several kilometers (the distance depends on the entity from small accidents to nuclear explosions or accidents on the reactor), sending an appropriate report and if there are no criminal or enemy intentions, forensic action teams should be contacted. Once the procedure for securing the area has been carried out, it is necessary to assess the possible presence of injuries and the dose rate levels. If there are injuries, emergency teams must be used to carry out the rescue and transport to the decontaminated area outside the accident area. As far as the dose rate is concerned, the reference cut-off is $2x10^{-}4$ cGy / h, if the levels recorded are higher, the segment area must be repositioned up to the permitted threshold level. If, on the other hand, the threshold value has not been exceeded, both air and surface β and γ radiation contamination must be assessed in order to establish the contaminated area. In the military sphere NATO doctrine indicates the monitoring priorities to be carried out in the period immediately following the reporting of an emergency, (phase I) with this sequence:

1. Cloud detection

For the detection of the cloud a common equipment is sufficient for all the sampling teams as well as an instrument for detecting the dose levels positioned one meter from the individual and three from the ground both with an open window (β + γ) and a window closed (γ).

2. Monitoring of ground deposition

This action should be carried out in an extended, open area, away from vehicles, buildings, trees, roads and busy areas, starting where atmospheric precipitations occurred during the passage of the cloud. More details on the composition and nature of radionuclides can be obtained by *in situ* γ spectrometry. A common equipment for high environmental dose rates and a monitor to assess contamination are sufficient to carry out the detection.

3. Source detection and its characterization

The detection of the source helps to assess the dose rate near a radioactive source and to provide timely information aimed at the protective actions to be taken. A common equipment is sufficient for all the sampling teams as well as an intensifier.

4. Detection of contaminated surface

Usually surface contamination can be determined by direct monitoring methods, in field situations of exposure to "mixed" radiation, appropriate tools must be used to distinguish between α and β and γ measurements. In some cases the radionuclides released could be pure α and β emitters and therefore do not produce high environmental dose rates. To discriminate the areas contaminated with γ radiations, measurements must be made with and without the protective cover between the measured surface and the sensor. In this circumstance it is sufficient to have a common equipment for all the surveillance/

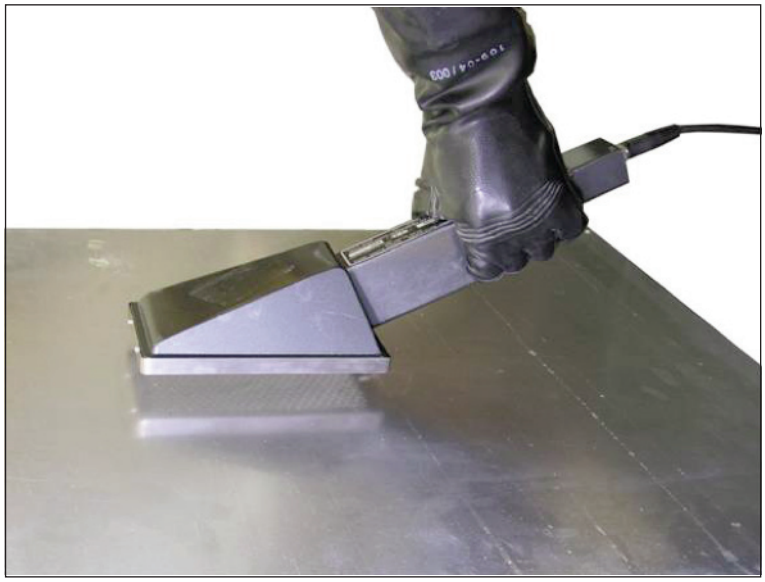

Figure 1 - Detection of contaminated surface.

sampling teams and for the additional and spare contamination detection tools (Figure 1).

5. γ in situ spectrometry

It is a procedure used to identify the composition of radionuclides in the radiological emergency and to determine the surface concentration of radionuclides deposited on the soil. In some special cases the measurements are finalized to a mapping, they are carried out with a NaI (Tl) or HPGe scintillator spectrometer, mounted on a vehicle and integrated by a GPS system. In this circumstance it is necessary to have the equipment common to all the teams, the spectrometric system, the support of the instrument (tripod), the liquid nitrogen, select the appropriate radionuclide libraries and the sensor conversion factors (Figure 2).

6. *Advanced detection of airborne contamination*

This is a procedure capable of providing information on a vast contaminated area through measurements of a specific radionuclide, so as to be able to undertake protective actions and / or environmental remediation actions. The detectors used are

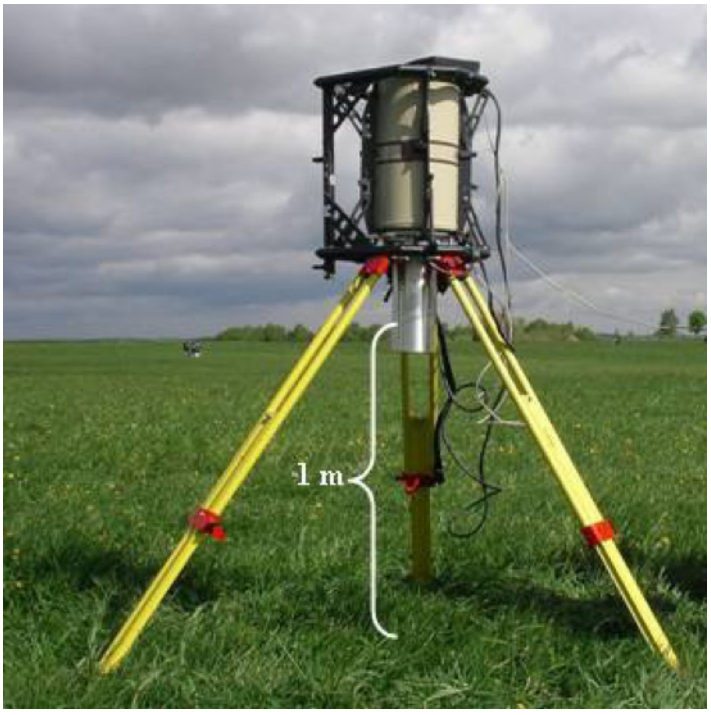

Figure 2 - γ *in situ* spectrometry.

preferably with HPGe but, if necessary, also with NaI (Tl). Aerial spectrometry γ is subject to considerable uncertainties due to differences between the current distribution of radionuclides on the soil and the distribution used to determine conversion factors, due to the nature of the soil (presence of forests, buildings, etc.) and to possible factors unknown. In this circumstance it is necessary to have the equipment common to all the teams, the spectrometric system, the support of the instrument (tripod), the liquid nitrogen, the correct radionuclide libraries, the sensor conversion factors and the helicopter or airplane fixed wings with GPS system and integrated telemetry.

7. *Monitoring of the aerial surveillance source*

This procedure aims to detect and locate the source or the γ emitting sources, so as to make them safe, take protective actions and/or support operations to the population involved. The tools to be preferred are those based on NaI (Tl), however systems can also be used that include or pressurized chambers for ionization, proportional counters, GM counters, all to be calibrated before use. In this circumstance it is necessary to have the equipment common to all the teams, the spectrometric system or the intensimeter, the γ aerial monitoring system and the helicopter or fixed wing aircraft with GPS system and integrated telemetry.

d. Indications to be followed in phase II

In the second phase (from several hours to weeks after the accident), urgent surveillance must be carried out integrated with the sampling and identification of radionuclides. In this context, means and teams carry out a sampling of the deposition on the ground and the execution of γ spectrometry in situ, then an analysis must be carried out on the food matrices (milk, food, vegetables), on the air, soil and water surface by using both field and fixed laboratories. In the military sphere NATO doctrine indicates the monitoring priorities to be carried out in the medium/late period (phase II) with this sequence:

1. Monitoring of ground deposition
2. Surveillance of the contaminated surface
3. Advanced surveillance of airborne contamination.

Monitoring procedures in the civil field (3, 5)

a. Indications to be followed in the first phase

In the civil field, the CEVaD, the Data Processing and Validation Center, part of the Civil Protection System in radiological emergencies, indicates the monitoring priorities to be carried out in the period immediately following the reporting of an emergency (phase I) with this sequence:

1. Intensity of dose γ from external irradiation
   To estimate the direct radiation from the cloud and from the ground, the dose intensity γ is measured by external irradiation, expressed in μSv/h or nSv / h; to carry out this survey the time available must be very short, about 30'. The instruments used for these measurements are the Reuter-Stokes pressure ionization chambers, organic scintillators, compensated Geiger and proportional counters.
2. Detection of atmospheric particulate matter
   To carry out this procedure it is first of all necessary to choose the ideal position, characterized by a minimum distance of two meters from the ground, being in an open field, avoiding areas of high dust and protecting the suction system from the action of atmospheric agents. It is also important to have data about the meteorological conditions that help to interpret the analysis results more precisely. To assess the concentration of atmospheric particulate matter in the air, different types of sampling can be used:

a. Medium-low volume suction systems (capacity 30-140 liters of air per minute), consisting of a filter (paper, glass, cellulose acetate or nitrate, activated carbon or zeolite / silver), filter holder, a pump suction and a volumetric meter. The Minimum Detectable Activity (MAR) levels are approximately 10^{-3} Bq / m^3.

b. Very high volume suction systems (capacity 1000-2000 m^3 of air per day) consisting of a filter (in glass), a suction pump and a volumetric meter.
   At an hour from the end of the sampling phase (up to a maximum of three and a half hours) high-resolution detection must be performed using γ spectrometry (usually a pon-type hyperpure germanium detector, with relative efficiency of around 30 %) directly on the filter, lasting 1.5 - 2 hours, without carrying out any sample manipulation.
   Some natural radionuclides such as Uranium-238 and Thorium-232 should also be included in the analysis, as they are always present in atmospheric particulate, in order to avoid the risk of false positives. The MAR levels in this case are around 0.1 Bq / m^3.
   The sample to be analyzed must also be subjected to alpha and total beta detection by means of a counting system (gas flow proportional counter, plastic scintillator, thin window Geiger-Muller) for a time varying between about 25 and 40 minutes. after having spent at least 120 hours from sampling to favor the decay of natural radionuclides. The MAR levels in this case are around 0.5 Bq / m^3 for the total beta and less than 0.05 Bq/ m^3 for the total alpha.

3. Wet and dry deposition on the ground

This evaluation is very important and can be performed with different techniques that complement each other, as they allow to overcome the limits imposed by the picking area itself.

a. *Direct measurement of deposited particulate matter (FALLOUT)*

With this technique the particulate that has deposited on the soil is measured. To take the sample, you must choose an area that has certain characteristics, that is, free from heavy dust and traffic, by placing the container in an open field at a height of two meters and near the intake system. The container must be in non-porous white plastic or stainless steel with a surface area of approximately 2 m^2, equipped with a protective

net on the mouth of the same to avoid external contamination, and present distilled water with HCl inside. The MAR levels in this case are around 0.5 Bq/m^2 for the Cesium 137 and 0.3 Bq/m^2 for the Sr-90.

b. *γ in situ spectrometry*

This is a rapid technique, carried out by a limited and trained number of operators, which allows a significant collection of both qualitative and quantitative data of the radiological emergency, on an area that can reach large dimensions around 300-400 m^2. To assess the levels of radioactivity on the ground an γ spectrometer is used *in situ* for a duration of about an hour, but it should be remembered that there may be uneven levels due to a distribution influenced by the time elapsed since the fallout, the composition of the land, site rainfall, presence / absence of vegetation. A particular and frequent use of this method is in evaluating the γ radiations emitted by sources, mostly unknown, considered punctiform, which although not strictly representing a real emergency are considered a health and social alarm. In this case the detector used is a germanium or NaI scintillator. In this case, the germanium or the cheaper NaI is present in the detector used.

c. *Bioaccumulative measures (bryophytes)*

Bryophytes or mosses are bioaccumulative organisms used both for the assessment of surface soil contamination and for deposition on it. Not all bryophytes are suitable for sampling, which must be carried out by qualified and trained personnel. We need to take 10-15 moss samples of about 1 cm thick, grown on a horizontal surface of about 100 cm² with a base of rocks; in this circumstance it is essential to know the contamination levels of the various sampling stations prior to the emergency. The samples must be subsequently broken up, taking care not to lose the powders, place everything in a special container (Marinelli beaker) and carry out the appropriate calibration with the γ spectrometer, which will give me results expressed in Bq/m^2 with the reported MAR to the action of the Cs-137.

d. *Measurements of surface soil samples*

Another type of sampling is the superficial soil extraction, which despite being laborious and of long duration, represents a valid indicator of the radioactivity dispersed in the terrestrial environment, above all if the interested area is limited. The choice of the site must be taken into account the criteria of representativeness in large-scale releases, while it is necessary to take into account the meteorological information and the modalities of release for small-scale cases. In both cases it is essential to know the wind direction and the possible presence of residential areas adjacent to the release area (it would be advisable to select sites far from trees or buildings that can screen during rainfall, at least 100 meters from roads) heavily trafficked, avoiding areas where water flows or stagnate and preferring those covered by grassy vegetation, with a good permeability to limit alterations from atmospheric agents. To sample, the first 5 centimeters of soil, including vegetation, must be taken for a surface area of approximately 500 - 1000 cm^2, for a total of up to 15 samples. The samples taken must be weighed, considering their water content and subsequently treated through: drying, sieving (with possible granulometric analysis) and homogenization, before placing them in a one-liter Marinelli container. To perform the analysis, it is necessary to subject the sample to γ spectrometry with HPGe and to evaluate both the contaminating radionuclides and the natural radionuclides. The concentration of radionuclides is expressed in various units of measurement such as the measured Bq/kg of fresh or dry mass, or the Bq/m^2 or Bq/m^3 for the measured sample surface/volume. It is appropriate to specify how the measured mass is the difference between the total mass of the sample taken and the total mass of the skeleton (stones, roots and foreign bodies), while the measured surface area is the ratio between the total surface area sampled per the measured mass and the total mass collected.

4. Evaluation of food matrices

The food matrices chosen for sampling are cow's milk, large-leaf edible vegetables, fresh forage, seasonal fruit, drinking water; also in this case the election container is the one liter Marinelli. The samples must be weighed before being analyzed, in some cases it is advisable to make the homogenization (fruit and vegetables) and define the density, which must be similar to that of the calibration source, and consider whether it is appropriate to make a correction for cars absorption in cases where radionuclides with low γ emissions have been found (Am-241 with 59.5 keV emission). The analysis is carried out by γ spectrometry with HPGe, and in the cases in which the sample consists of cow's milk and/or broad-leaf vegetables with liquid scintillation by Sr-90. The MAR both in the case of research of 137 Cs and in the case of 90 Sr is equal to 1 Bq/kg.

b. Directions to follow in phase II

In the civil field, the CEVaD indicates a list of additional monitoring measures (to those already described in phase I) to be carried out in phase II:

1. In addition to the evaluation of wet and dry soil deposition:
   a. bioaccumulators and indicators of the presence of contamination, not relevant to the diet such as honey, mushrooms, game, molluscs, crustaceans and aromatic herbs
   b. internal and marine surface waters
   c. sediment organic mineral debris (DMOS)
   d. marine, lake and river sediments.
2. in addition to the food matrices they must also be monitored:

Sheep and goat milk, powdered milk, milk derivatives, meat and fish, cereals, oil, wine, grapes and seasonal vegetables/fruits. Sampling of bioaccumulators and matrices must be collected in a one-liter or smaller Marinelli container (0.5 l or 200 ml or less). If the sample is liquid in nature, treatment is not necessary, which must also be carried out by homogenization in

other cases (meat, vegetables, etc.) and assessment of the density almost identical to that of the calibration source. The analysis is performed by γ spectrometry with HPGe, while the 90 Sr. is limited to milk. The MAR both in the case of 137 Cs research and in the 90 Sr case is equal to 1 Bq/l. If instead we need to sample surface waters of rivers or lakes, and/or seas, at points where turbulence and speed are lower; the containers to be used must be in polyethylene with a capacity of between 30 and 90 liters. The sample in this case is treated by adding nitric acid or HCl at 37% and subsequently reduced by passage on a column with ion exchange resins or by evaporation. The analysis is carried out by γ spectrometry with HPGe on the resins or on the dry residue and the MAR in this case is equal to 1Bq/l. The sampling of sedimentable organic mineral debris (DMOS) is carried out on river particulate in the sedimentation phase, at the same points where routine monitoring takes place. The duration of this procedure is usually about 7 days, it can be decreased with an increase in the number of samplers. The DMOS must be subjected to a pretreatment that allows the separation of the aqueous component and placed in a Marinelli container with a capacity of 1 liter or less. The analysis is performed by γ spectrometry with HPGe, or possibly by measuring the Sr-90. The MAR both in the case of 137 Cs research and in the 90 Sr case is equal to 1 Bq/kg.

Discussion

The civil and military monitoring procedures are mostly identical starting from the instrumentation used to carry out surveillance and monitoring (6, 7).

If the monitoring procedures are compared in the first phase it can be concluded that they are identical, emphasizing that in the civil sphere there is a particular attention to food matrices and bioaccumulators, while in the military field there is a greater interest in the advanced surveillance of airborne contamination.

In the medium and late phases, here considered more generally as phase II, it is possible to find the same attention observed in the first phase, with greater interest on the part of the military bodies in charge of an advanced surveillance of an aerial contamination.

As regards the monitoring operations on the national territory, the 7th NBC Regiment set up in Civitavecchia (RM), can act in favor of Bodies/Commands/Departments of the Defense Administration (AD) or in competition with the Civil Protection operating structures and of the bodies of the Ministry of the Interior.

During radiological and/or nuclear emergencies in the Defense area, actions are taken to protect personnel, vehicles, materials, infrastructures and areas, provided for by the relative "AD Plan", integrating the units of the regiment previously mentioned with the authorized personnel. NBC of the local authority/headquarters/department.

In this case the tasks assigned are:

1. Carrying out checks on environmental radioactivity with contaminated areas, carrying out the monitoring procedures, including sampling and analysis discussed in the previous chapters, exclusively within the area pertaining to the A.
2. Carrying out activities of radiological remediation of personnel, infrastructures, vehicles and materials and areas, starting from those where the personnel work, so as to limit the spread of contamination and reduce personnel exposure.
3. Consulting activities to the Bodies/Commands/Departments concerned about the protective measures to be implemented against men and means.

During radiological and/or nuclear emergencies in events of public calamity and environmental protection in the national territory, the "*National plan of protective measures against radiological emergencies*" is implemented, which specifies the competitions that the units of the 7th NBC Regiment they can provide, that is:

1. Competition for the evacuation of contaminated areas
2. Reclamation of personnel, infrastructures, vehicles and materials and areas involved
3. Competition for the monitoring procedures of the situation of competence of regional authorities (Fire Fighters and ARPA) and national (ISPRA).

It is therefore essential to implement the synergy, already in force, between military and civilian operators in radiological and/or nuclear emergencies, standardizing as much as possible the procedures for action.

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