ORIGINAL ARTICLE

Study on hepatitis B and C serologic status among municipal solid waste workers in Messina (Italy)

R. SQUERI, V. LA FAUCI, L. SINDONI, G. CANNAVÒ*, E. VENTURA SPAGNOLO*
University of Messina. Department of Hygiene, Preventive Medicine and Public Health;
* University Hospital "G. Martino", Health Administration, Messina, Italy

Key words

Hepatitis • Municipal solid waste workers • Seroprevalence

Summary

A study on hepatitis B and C virus seroprevalence was carried out on blood samples from 327 municipal solid waste workers in Messina (Italy) to verify the hypothesis that this category of workers is at high risk for such diseases. The fact that 32.41% of all the subjects showed previous exposure to hepatitis B virus (HBV) substantiates the need to proceed with compulsory HBV vaccine prophylaxis in this category of workers, also in anticipation of possible medical legal litigations.

Introduction

The extent of the problem of exposure to biological hazards is certainly greater that what is often believed, especially in those working environments without the known presence of biological agents dangerous to one's health; the underestimation of the actual hazards is in itself the greatest hazard of them all [1-6]. Legislative Decree 626/94, as modified by Legislative Decree 242/96, represents the acceptance of Directive 89/391/EEC and the subsequent six Directives on the safety and protection of workers' health; among these there is also Directive 90/679/EEC on the protection from biological agents [7-10]. Undoubtedly, the latter marks an important turning point for the protection of workers from hazards due to exposure to biological agents during work, something that is not restricted to the prescription of hygiene standards or good microbiological practice, but imposes the implementation of a whole series of obligations relative to the assessment of the risk, workers' information, notifications to responsible Authorities, health surveillance and specific control measures to be adopted for the working areas. As regards health surveillance, article 86 of title VIII requires its implementation for those workers exposed to biological agents, underlining the availability of effective vaccines for those workers who are not yet immunised [11]. Regarding this problem, the non-extension of the present range of compulsory vaccinations to some professional categories at risk is worthy of note. It is simply stated that the vaccine is to be made available, or that it is to be free of charge, as in the case of hepatitis B (former Decree of the Health Ministry 4 October 1991) to those workers exposed to specific infectious hazards; among these workers we also find municipal solid waste workers who, regardless of their tasks (drivers, sweepers or incinerator operators) and their professional training, clearly perform an activity that is at high risk of infection because of the type of material with which they come into contact. In this situation, beyond a generic risk of accidents, the prevention, where possible, of those infectious diseases against which we have effective vaccines (such as hepatitis B), would seem not only imperative (Law 626/94 and integrations) but obvious; however, as one can deduce from the above, all this is not yet contemplated by the legislator. The aim of our work has been to investigate, through a seroprevalence study towards hepatitis B and C, the serologic profiles of a sample of municipal solid waste workers in the province of Messina, with the intent to verify the reasonable hypothesis of high infectious risk towards these diseases, thus further emphasizing the importance of adequate prophylactic measures within this category of workers.

Methods

Between March and May 2005, the sera of 327 municipal solid waste workers, from 20 to 68 years of age, responsible for sweeping as well as collection and disposal of household waste, were analysed for the likely presence of antibodies to hepatitis B and C viruses. The study was carried out using the automated Abbott IMX System, which uses the Microparticle Enzyme Immune Assay (MEIA) method (Abbott Laboratories, Illinois, USA). In short, this microparticle capture enzyme immuno-assay is an automated system for measuring specific antibody by interaction with antigen-coated particles. Having incubated the microparticles and the serum being tested, the reaction mixture is transferred to an inert glass fibre matrix to which the particles bind irreversibly. The immune complex is transferred from the glass fibres while the reaction mixture rapidly spills out of the large pores of the matrix. The detection of the immune complexes on the glass fibre matrix is accomplished by using an alkaline phosphatase-marked conjugate, which catalyses the hydrolysis of 4-methyl-

umbellipheryl phosphate to 4-methyl–umbellipherone. The speed at which this latter molecule is formed is proportional to the concentration of the analyte in the sample being tested. At the end of the laboratory assays, we consulted the paper records of the vaccination office of Local Health Unit (LHU) 5 of Messina, to identify the percentage of municipal solid waste workers vaccinated against hepatitis B and the number of vaccine doses administered, thus being in the position to compare these data and the laboratory data. Furthermore, the municipal solid waste workers were given a questionnaire to identify the presence of risk factors for hepatitis B and/or C. The statistical significance tests were done according to the Pearson's χ^2 method using the Epi Info 6.04d software (Centers for Disease Control and Prevention, Atlanta, USA).

Results and Discussion

Table I shows the immunological status of the municipal solid waste workers studied relative to hepatitis B and C virus. 120 municipal solid waste workers (36.70%) are negative to HBV and HCV antibodies; of these, 1.22% belong to the 20-30 age group, 12.84% to the 31-40 age group, 11.31% to the 41-50 age group and 11.31% to > 50 years age group. The remaining 207 (63.30%) were found to be positive to different HBV markers, anti HCV antibodies and precedent HBV-HCV co-infection; 7 of them (2.14%) belong to the 20-30 age group, 51 (15.59%) to the 31-40 age group, 72 (22.01%) to the 41-50 age group and 77 (23.54%) are over 50 years old. If we examine these results more closely we can see that in 117 municipal solid waste workers there is only the presence of HbsAb, due mainly to vaccination (98 subjects) (Tab. III) and in the remaining 19 due to an infection. We also observed a condition indicative of recovery in 62 municipal solid waste workers (18.96%) for the presence of HBsAb+/HBcAb+ or HBsAb+/HBcAb+/HBeAb+ or HBcAb/HBeAb; of chronic carrier in 13 subjects (3.98%) for the presence of HBsAg+/HBcAb+/HBeAb; of chronic hepatitis in 7 (2.14%) for the presence of HBcAb; of HBV/HCV co-infection in 5 (1.53%) and finally we found 3 workers (0.92%) with only antibodies to HCV. Out of the 327 municipal solid waste workers, only 136 (41.59%) had been vaccinated against hepatitis, of these 65 (47.79%) had completed the vaccine cycle, 46 (33.82%) had only taken two doses and 25 (18.38%) only one dose (Tab. II). In comparing the group of subjects that had completed the vaccine cycle and those that had taken only 1 or 2 doses, we observed that the first group had a percentage of serum conversion significantly higher than the second group ($p < 0.01$) with a percentage of response to vaccination progressively higher with increasing number of administered do-

Tab. I. Overall serologic status of all municipal solid waste workers examined according to age groups.

	Age groups (years)				
Serologic profiles	20-30 %	31-40 %	41-50 %	> 50 %	total %
HBsAb+	7 (2.14)	37 (11.31)	34 (10.40)	39 (11.93)	**117 (35.78)**
HBsAb– HCVAb-	4 (1.22)	42 (12.84)	37 (11.31)	37 (11.31)	**120 (36.70)**
HBsAb+ HBcAb +	0	4 (1.22)	11 (3.36)	15 (4.59)	**30 (9.17)**
HBsAb+ HBcAb+ HBeAb+	0	3 (0.92)	14 (4.28)	10 (3.06)	**27 (8.26)**
HBsAg+ HBcAb+ HBeAb+	0	3 (0.92)	8 (2.45)	2 (0.61)	**13 (3.98)**
HBcAb+ HBeAb+	0	1 (0.31)	1 (0.31)	3 (0.92)	**5 (1.53)**
HBcAb+	0	0	1 (0.31)	6 (1.84)	**7 (2.14)**
HCVAb+	0	0	3 (0.92)	0	**3 (0.92)**
HCVAb+ HBcAb+ HBeAb+	0	1 (0.31)	0	0	**1 (0.31)**
HCVAb+ HBsAb+ HBcAb+ HBeAb+	0	1 (0.31)	0	1 (0.31)	**2 (0.61)**
HCVAb+ HBsAb+ HBcAb+	0	1 (0.31)	0	1 (0.31)	**2 (0.61)**
	11 (3.36)	**93 (28.44)**	**109 (33.33)**	**114 (34.86)**	**327**

Tab. II. Percentage of seroconversions among the municipal solid waste workers examined relative to the number of vaccine doses and corresponding age groups. Out of 38 HbsAb-negative subjects, 30 were positive for other markers of precedent hepatitis B infection.

	vaccinated per age group HBsAb+				
	20-30 %	31-40 %	41-50 %	> 50 %	Total %
1 dose	0	3 (3.06)	2 (2.04)	2 (2.04)	7 (7.14)
2 doses	0	13 (13.27)	13 (13.27)	9 (9.18)	35 (35.71)
3 doses	1 (1.02)	9 (9.18)	27 (27.55)	19 (19.39)	56 (57.14)
	1 (1.02)	**25 (25.51)**	**42 (42.86)**	**30 (30.61)**	**98**
	vaccinated per age group HBsAb-				
	20-30 %	31-40 %	41-50 %	> 50 %	Total %
1 dose	1 (2.63)	4 (10.53)	6 (15.79)	7 (18.42)	18 (47.37)
2 doses	1 (2.63)	2 (5.26)	3 (7.89)	5 (13.16)	11 (28.95)
3 doses	0	2 (5.26)	3 (7.89)	4 (10.53)	9 (23.68)
	2 (5.26)	**8 (21.05)**	**12 (31.58)**	**16 (42.11)**	**38**

ses. Table III shows the serological status of 136 vaccinated subjects and 191 non-vaccinated ones. Among the 136 vaccinated subjects, in 98 subjects (72.06%) we detected the presence of HBsAb; 8 (5.88%) had not seroconverted while in the remaining 30 we detected a serological status indicative of precedent contact with the hepatitis B virus, which resulted in a serological status of recovery in 23 subjects (16.91%), chronic hepatitis in 2 subjects (1.47%) and a condition of acute hepatitis in 3 (2.21%); finally in 2 workers we detected the presence of hepatitis B and hepatitis C co-infection. Out of 191 non-vaccinated subjects, 61 (31.93%) showed a serologic status indicating previous contact with HBV and recovery (HBsAb, HBsAb/HBcAb, HBsAb/HBcAb/HBeAb, HBcAb/HBeAb, HCVAb/HBcAb/HBeAb, HCVAb/HBsAb/HBcAb/HBeAb, HCVAb/HBsAb/HBcAb), 112 (58.64%) were found to be negative for all hepatitis B and/or C markers, 11 (5.76%) were in the condition of chronic hepatitis B (HBcAb), 4 (2.09%) showed a serological status of hepatitis B in progress (HBsAg/HBcAb/HBeAb), 3 (1.56%) had only antibodies to HCV, and finally 3 others (1.56%) showed HBV/HCV co-infection.

Tab. III. Serologic profiles of all municipal solid waste workers examined relative to their vaccine status against HBV.

Serologic profiles	HBV vaccinated %	non vaccinated %	total %
HBsAb+	98 (72.06)	19 (9.95)	117 (35.78)
HBsAb-	8 (5.88)	112 (58.64)	120 (36.70)
HBsAb+, HBcAb+	9 (6.62)	21 (10.99)	30 (9.17)
HBsAb+, HBcAb+, HBeAb+	14 (10.29)	13 (6.81)	27 (8.26)
HBsAg+, HBcAb+, HBeAb+	2 (1.47)	11 (5.76)	13 (3.98)
HBcAb+, HBeAb+		5 (2.62)	5 (1.53)
HBcAb+	3 (2.21)	4 (2.09)	7 (2.14)
HCVAb+		3 (1.57)	3 (0.92)
HCVAb+, HBcAb+, HBeAb+		1 (0.52)	1 (0.31)
HCVAb+, HBsAb+, HBcAb+, HBeAb+	1 (0.74)	1 (0.52)	2 (0.61)
HCVAb+, HBsAb+, HBcAb+	1 (0.74)	1 (0.52)	2 (0.61)
	136 (41.59)	**191 (58.41)**	**327**

Conclusions

The following conclusions can be drawn by examining the results reported in Table III: (a) 183 municipal solid waste workers (55.96%) are protected against HBV because of the presence of HBsAb (HBsAb, HBsAb/HBcAb, HBsAb/HBcAb/HBeAb, HCVAb/HBcAb/HBeAb, HCVAb/HBsAb/HBcAb/HBeAb, HCVAb/HBsAb/HBcAb), almost all or 98 (53.55%) from vaccination and 85 (46.44%) from precedent contact with HBV and consequent recovery, whereas 120 municipal solid waste workers (36.70%) are at risk because of lack of protective antibodies; the real exposure to the hepatitis B virus, documented by the presence of antibodies and antigens in vaccinated and non vaccinated subjects, is indicated by 106 subjects, i.e. by 32.41% of all the subjects examined in the study; among them 5 (1.52%) who had come into contact with both HBV and HCV and 3 (0.92%) exclusively with the latter and, furthermore, 30 of the 38 subjects that were found to be negative to HBsAb markers also had antibodies indicating previous infection with HBV. None of the workers, however, had any anamnesis recollection of symptoms and/or specific signs; 25.43% reported accidental wounds during their working activity, no one reported using drugs while 34.51% reported to have had unprotected sex. The presence of serologic markers other than HBsAb in vaccinated subjects is of particular importance because it enables us to put forward two hypotheses: (a) the presence of these markers could be attributed to the lack of seroconversion after the vaccine; (b) these markers were present prior to the vaccination due to a previous contact with the virus. Given the high percentage of subjects that had come into contact with HBV (32.41%), it would be advisable, for categories of particularly high-risk workers, to check when they are hired the serologic status before and after vaccination, both to carry out specific procedure in case of lack of seroconversion (additional vaccine doses or seroprophylaxis in non-responder subjects in case of accidental cuts), and for medical legal purposes. Moreover, because the antihepatitis B vaccination has been compulsory since 1991 for all newborns and for 12-year-olds on that date and for subsequent 12 years, vaccination is recommended for subjects over 24 years old among the categories at risk specified by the Ministerial Decree though free of charge [11-14]. Health and vaccine surveillance, in fact, cannot be only at the end of a process that, starting from the hazard assessment, ensures adequate protection for the workers exposed, but should be the starting input for effective preventive measures [9, 10, 14]. Bearing in mind that, from an insurance point of view, Italian Law equates infectious diseases to work-related accidents and that consequently, these are subject to indemnity whenever a causal connection with the working activity can be demonstrated [13] and seeing that vaccination, outside the compulsory age group, is only recommended and the employee can refuse to take it, it is essential for the workers to be adequately informed on the disease, the way it is transmitted and how it can be prevented. A consequence of this could be possible medical legal litigation undertaken by the worker who had not been offered the vaccination and is then affected by the infectious disease deemed to have been caught at work. It should be stressed that, even in other European and non-European countries the problem has been raised with similar arguments [4-6] and, particularly Dounias and co-workers [6], have come to conclusions that are similar to ours starting from statistical and rational bases that are essentially the same.

References

[1] Cananzi F, Quartarone F, De Francesco A, Mancuso E, Bertuccio, Lombardo G. *Prevalenza dei markers dell'epatite virale B in un campione di soggetti addetti alla raccolta dei rifiuti solidi urbani*. Rassegna Medica 1997;4:1-6.

[2] Cimino J. *Health and safety in the solid waste industry.* Am J Public Health 1975;65:38-46.

[3] Corrao J, Zotti C, Sciavolleli A, Bosia S, Piccioni P. *Infezioni da virus delle epatiti A e B negli addetti alla raccolta rifiuti di Asti*. G Ital Med Lav 1985;7:145-7.

[4] Ferreira J, Tambellini A, Da Silva C, Guimares M. *Hepatitis B morbidity in municipal and hospital waste collection workers in the city of Rio de Janeiro*. Infect Control Hosp Epidemiol 1999;9:591-2.

[5] Dorevitch S, Marder D. *Occupational hazards of municipal waste workers.* Occup Med 2001;16:125-33.

[6] Dounias G, Kypraiou E, Rachiotis G, Tsovili E, Kostopoulos S. *Prevalence of hepatitis B virus markers in municipal solid waste workers in Keratsini (Greece).* Occup Med 2005;55:60-3.

[7] Legislative decree 626/94: *Attuazione delle Direttive 89/391/CEE, 89/654/CEE, 89/655/CEE, 89/656/CEE, 90/269/CEE, 90/270/CEE, 90/394/CEE, 90/679/CEE, riguardanti il miglioramento della sicurezza e della salute dei lavoratori sul luogo di lavoro. G.U. n. 141 del 12 Novembre 1994.*

[8] Faino A. *Legge 626/94: la gestione della sicurezza sul lavoro come strumento di miglioramento della qualità aziendale*. L'Igiene Moderna 1999;111:349-62.

[9] Grandi C, Mucci N, Bergamaschi A. *Protezione da agenti biologici negli ambienti di lavoro: considerazioni sul titolo VIII del Decreto Legislativo 626/94*. Ann Ig 1998;10:103-20.

[10] Ministry of Health: issue n. 19 of 11/30/2000.

[11] Malaguti Alberti L. *Gestione del rischio biologico nei luoghi di lavoro: spunti di riflessione*. Notiziario Istituto Superiore di Sanità 2002;15.

[12] Ministry of Health: Progetto AIDS-ISS. *Proposta di raccomandazioni per la chemioprofilassi con antiretrovirali dopo esposizione occupazionale ad HIV, ed indicazioni di utilizzo nei casi di esposizione non occupazionale*. Roma 19 marzo 2002.

[13] Del Cimmuto A, Boccia S, Raffo M. *Sorveglianza Sanitaria in lavoratori addetti ad una discarica controllata*. L'Igiene Moderna 1999;111:253-69.

[14] Serafini G. *Rischio biologico e profilassi vaccinale negli operatori ecologici.* In: Mediamix ed. *Legge 626/94 Rischio biologico e profilassi vaccinale*. Milano 1997, pp. 28-30.

■ Received on March 1, 2006. Accepted on May 18, 2006.

■ Correspondence: Prof. Livio Sindoni, Department of Hygiene, Preventive Medicine and Public Health, AOU "G. Martino", Torre Biologica, via Consolare Valeria, 98125 Messina, Italy - Tel. +39 090 2213349 - Fax +39 090 2213351 - E-mail: lsindoni@unime.it