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LETTER TO THE EDITOR

PsoBioVax: A multicentric Italian case–control study of the immunological response to anti-SARS-CoV-2 vaccine among psoriatic patients under biological therapy

Dear Editor,

The role of vaccination has been crucial in limiting COVID-19.[1] The efficacy of vaccines among patients with immune-mediated inflammatory disease has been investigated showing promising results.[2] Patients with psoriasis under biological treatment had a valid response to the COVID-19 vaccines.[2,3] However, many of these studies included small cohorts.[3,4] Hence, we decided to conduct a cohort multicentre study on 13 Italian outpatient dermatologic services to investigate the humoral immune response and safety of the anti-COVID-19 vaccines among psoriatic patients under biological therapy. Psoriatic adults (≥18 years) under biological therapy for ≥6 months who received two doses of the anti-SARS-CoV-2 vaccine and were tested for anti-spike protein receptor-binding domain (S-RBD) antibodies between 1 and 6 months after the last vaccine shot were included in the study. A control group was also included, composed of healthcare practitioners of the participating centres, vaccinated against COVID-19 who had performed the S-RBD neutralizing antibody assay within 1–6 months after vaccination. A multiple linear regression with the logarithm of antibody count as dependent, the indicator of being a psoriatic patient as exposure and the main study characteristics as potential confounders was performed, to assess whether psoriatic patients had different antibody levels than controls. In this regression, robust standard errors were obtained to account for the clustering of subjects in the participating centres. A similar multiple logistic regression was performed to assess whether patients

TABLE 1 Patients' and controls' characteristics.

	Total ($n=502$)	Patients ($n=346$)	Controls ($n=152$)	Test; p-value
Age (years)	50.5 ± 14.6	54.5 ± 13.2	41.2 ± 13.6	9.2; <0.001[a]
Females	221 (44.5%)	134 (38.7%)	87 (57.6%)	15.2; <0.001[b]
Ongoing type of biological therapy		346 (100%)	–	–
Anti-TNFα		127 (36.7%)		
Anti-IL-12/23		49 (14.2%)		
Anti-IL-17		100 (28.9%)		
Anti-IL-23		70 (20.2%)		
Vaccine				
Pfizer	443 (89.1%)	296 (85.5%)	147 (97.3%)	15.0; <0.001[b]
Moderna	32 (6.4%)	28 (8.1%)	4 (2.7%)	
AstraZeneca	18 (3.6%)	18 (5.2%)	0	
J&J	4 (0.8%)	4 (1.2%)	0	
Previous SARS-CoV2 infection	33 (6.6%)	22 (6.4%)	11 (7.3%)	0.15; 0.703[b]
Time from 1st vaccination to serological test (months)	3.61 ± 2.37	3.45 ± 2.28	3.95 ± 2.56	−4.2; <0.001[a]
Antibody levels (mean ± ds)[c]	881.3 ± 1453.7	865.9 ± 1495.9	916.6 ± 1356.2	−1.4; 0.172[a]
Antibody levels (median and IQR)[c]	400 (113.4–987)	333.5 (96–988)	400 (158–958)	−1.4; 0.172[a]
Antibody response = strong	435 (87.5%)	309 (89.3%)	126 (83.4%)	3.3; 0.069[b]

[a] t-Test.

[b] Chi-square test.

[c] The statistical test was conducted on the natural logarithm of antibody levels.

had a different likelihood than controls to show a strong antibody response. A total of 346 patients and 151 controls were enrolled (497 subjects). None of the patients were under traditional systemic therapies in addition to biological therapy. Detailed patients' information is described in Table 1.

None of the patients discontinued treatment during the study period. However, 39 patients (10.6%) delayed the administration of biological therapy after vaccination (23.3 ± 12.8 days). The main reasons were suspicion of interaction between the two injections (23 patients), request for reassurance from health personnel (10 patients), personal reasons (6 patients). The average number of days of delayed administration was 23.3 ± 12.8. No serious adverse events (AEs) were reported, while about one-fourth of patients and controls reported mild AEs (injection site pain, fever and fatigue).

In both groups, the antibodies response was strong: in 309 patients (89.3%) and 126 controls (83.4%). The median antibody level was 333.5 U/mL among patients and 400 U/mL among controls (Mann–Whitney test: $z = -1.37$, $p = 0.172$). Multiple linear regression confirmed that after adjusting for the main study variables, antibody levels were not significantly different between patients and controls (patients' $b = -0.121$, $p = 0.817$) (Table 2). Of note, only the type of vaccine displayed a significant association with antibody levels (higher for subjects vaccinated with Janssen and lower for AstraZeneca), although with wide confidence intervals due to the extremely limited number of subjects who received these vaccines. Patients showed a higher yet not statistically significant probability than controls of having a strong antibody response (OR = 2.465, $p = 0.206$, Table 3). Our findings are in line with other studies which investigated the immunogenicity of anti-SARS-CoV-2 vaccines among patients with several inflammatory diseases and under immunosuppressive therapies.[2,5] As stated by Chiricozzi et al.,[6] psoriatic patients under biotechnological drugs do not have lower antibody response to different immunizations. Biologics are, indeed, immune-modulators, not interfering with antibody count6. On regards to the type of vaccine, according to our analysis Moderna and AstraZeneca seemed to have a lower probability of strong antibody response than BNT, as well as subjects with older age. This is in line with other analysis, describing cohorts

TABLE 2 Multiple linear regression of antibody levels on exposure (patients vs. controls), adjusted for the main individual characteristics.

	Coefficient	95% CI	*t*	*p*-Value
Patients	−0.121	−1.200, 0.959	−0.24	0.817
Age	−0.003	−0.017, 0.012	−0.39	0.701
Female sex	0.065	−0.291, 0.420	0.38	0.707
Vaccine				
Pfizer	Ref.			
Moderna	−0.372	−0.821, 0.077	−1.74	0.099
AstraZeneca	−0.893	−1.827, 0.040	−2.01	0.060
J&J	0.855	0.111, 1.600	2.41	0.027
Time from 1st vaccination to serological test (months)	0.017	−0.092, 0.126	0.33	0.742
Previous SARS-CoV2 infection	0.243	−0.735, 1.222	0.52	0.608
constant	5.742	4.735, 6.749	11.98	0.000

Note: Natural logarithm-transformed antibody levels were used.

TABLE 3 Multiple logistic regression of strong antibody response on exposure (patients vs. controls), adjusted for the main individual characteristics.

	Odds ratio	95% CI	*z*	*p*-Value
Patients	2.465	0.609–9.974	1.26	0.206
Age	0.986	0.972–1.001	−1.84	0.066
Female sex	1.034	0.699–1.529	0.17	0.868
Vaccine				
Pfizer	Ref.			
Moderna	0.359	0.170–0.757	−2.69	0.007
AstraZeneca	0.212	0.083–0.542	−3.24	0.001
J&J	Empty			
Time from 1st vaccination to serological test (months)	0.999	0.856–1.166	−0.01	0.994
Previous SARS-CoV2 infection	1.079	0.271–4.293	0.11	0.914
_cons	4.539	1.264–16.301	2.32	0.020

of 48 patients[3] and 120 patients.[4] The safety profile resulted from our study was in line with data previously presented[7,8]: No differences were seen between patients and controls. Among our patients, none discontinued treatment during the study period, but a 10% delayed the administration. This is consistent with the analysis from German Registries[9] where 23.7% of patients interrupt their systemic therapy during vaccination (14–90 days) mostly for the same reasons of our patients.

To conclude, anti-SARS-CoV-2 vaccinations has demonstrated a valid humoral response and safety profile also among psoriatic patients undergoing biological treatments.

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None.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author, MAC. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

L. Sacchelli[1,2]
F. Filippi[1,2]
A. Balato[3]
R. Balestri[4]
F. Bellinato[5]
N. Bernardini[6]
L. Bianchi[7]
M. Burlando[8]
A. Campanati[9]
M. A. Chessa[1,2]
M. Corazza[10]
A. Di Cesare[11]
V. Di Lernia[12]
F. Diotallevi[9]
M. Esposito[13,14]
M. C. Fargnoli[13,14]
P. Gisondi[5]
A. Giunta[15]
K. Hansel[16]
M. Magnano[4]
M. Megna[17]
G. Odorici[10]
F. Prignano[11]
C. Potenza[6]
G. Rech[4]
M. Rovesti[18]
A. Ruggiero[17]
F. Satolli[19]
L. Stingeni[16]
D. Gibertoni[20]
F. Bardazzi[1,2]

[1]*Dermatology Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Policlinico S. Orsola-Malpighi, Bologna, Italy*
[2]*Department of Medical and Surgical Sciences, Alma Mater Studiorum, University of Bologna, Bologna, Italy*
[3]*Unit of Dermatology, University of Campania Luigi Vanvitelli, Naples, Italy*
[4]*Division of Dermatology, Psoriasis Outpatient Service, APSS, Trento, Italy*
[5]*Dipartimento di Medicina Sezione Di Dermatologia Università di Verona, Verona, Italy*
[6]*Department of Medico-Surgical Sciences and Biotechnologies Faculty of Pharmacy and Medicine Sapienza University of Rome – Polo Pontino (ASL Latina), Latina, Italy*
[7]*Dermatology, University of Rome Tor Vergata, Rome, Italy*
[8]*Department of Dermatology, DISSAL University of Genoa, IRCCS Ospedale Policlinico San Martino, Genova, Italy*
[9]*Dermatological Clinic, Department of Clinical and Molecular Sciences, Polytechnic Marche University, Ancona, Italy*
[10]*Department of Medical Sciences, Section of Dermatology and Infectious Diseases, University of Ferrara, Ferrara, Italy*
[11]*Department of Health Sciences, Section of Dermatology, University of Florence, Florence, Italy*
[12]*Dermatology Unit, Arcispedale Santa Maria Nuova, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy*
[13]*Biotechnological and Applied Clinical Sciences, University of L'Aquila, L'Aquila, Italy*
[14]*Dermatology Unit, Ospedale San Salvatore, L'Aquila, Italy*
[15]*Dermatology, Fondazione PTV Policlinico Tor Vergata, Rome, Italy*
[16]*Dermatology Section, Department of Medicine and Surgery, University of Perugia, Perugia, Italy*
[17]*Section of Dermatology, Department of Clinical Medicine and Surgery, University of Naples Federico II, Napoli, Italy*
[18]*Dermatologic Unit, Ospedale "Guglielmo da Saliceto", Piacenza, PC, Italy*
[19]*UOC Dermatologia, University of Parma, Parma, Italy*
[20]*Research and Innovation Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy*

Correspondence
M. A. Chessa and L. Sacchelli, Via G. Massarenti, 1, 40138 Bologna, Italy.
Email: marcoadriano.chessa@gmail.com; lidia.sacchelli@gmail.com

L. Sacchelli and F. Filippi contributed equally.

ORCID

L. Sacchelli https://orcid.org/0000-0003-4388-4523
F. Filippi https://orcid.org/0000-0001-8173-4257
A. Balato https://orcid.org/0000-0001-5485-0172
R. Balestri https://orcid.org/0000-0002-0885-054X
F. Bellinato https://orcid.org/0000-0002-6163-6921
N. Bernardini https://orcid.org/0000-0002-6295-3574
M. Burlando https://orcid.org/0000-0002-4381-6718
A. Campanati https://orcid.org/0000-0002-3740-0839
M. A. Chessa https://orcid.org/0000-0002-0149-8870
A. Di Cesare https://orcid.org/0000-0002-1001-4604
M. Esposito https://orcid.org/0000-0002-4773-6993
M. C. Fargnoli https://orcid.org/0000-0002-7249-2556
P. Gisondi https://orcid.org/0000-0002-1777-9001
A. Giunta https://orcid.org/0000-0003-3589-9346
K. Hansel https://orcid.org/0000-0002-6674-4278
M. Magnano https://orcid.org/0000-0001-9429-9004
M. Megna https://orcid.org/0000-0003-1803-2046
G. Odorici https://orcid.org/0000-0002-5910-8994
F. Prignano https://orcid.org/0000-0002-5997-2045
A. Ruggiero https://orcid.org/0000-0002-4658-7391
L. Stingeni https://orcid.org/0000-0001-7919-8141
D. Gibertoni https://orcid.org/0000-0002-1722-3724

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