**Polypharmacy and sarcopenia in hospitalized older patients: results of the GLISTEN study**

**Polypharmacy and sarcopenia in hospitalized older patients: results of the GLISTEN study.**

Agosta Luca[1], Bo Mario[1], Bianchi Lara[2], Abete Pasquale[3], Bellelli Giuseppe[4], Cherubini Antonio[5], Corica Francesco[6], Di Bari Mauro[7], Maggio Marcello[8], Manca Giovanna Maria[9], Rizzo Maria Rosaria[10], Rossi Andrea[11], Landi Francesco[12], and Volpato Stefano[2]; for the GLISTEN Group Investigators[*].

1) Geriatria e Malattie Metaboliche dell'Osso, Dipartimento di Scienze Mediche, Città della Salute e della Scienza-Molinette, Torino, Italy.
2) Department of Medical Science, University of Ferrara, Italy.
3) Department of Translational Medical Sciences, University of Naples Federico II, Italy.
4) Geriatric Unit, S. Gerardo Hospital, Monza, Italy.
5) Geriatrics and Geriatrics Emergency Care, Italian National Research Center on Aging IRCCS-INRCA), Ancona, Italy.
6) Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy.
7) Geriatric Intensive Care Unit, Department of Geriatrics and Medicine, Azienda Ospedaliero-Univesitaria Careggi, Florence, Italy.
8) Department of Clinical and Experimental Medicine, Geriatric Rehabilitation Department, University of Parma, Italy.
9) UOC di Geriatria, Ospedale SS.Trinità, ASL 8 Cagliari, Italy.
10) Department of Medical, Surgical, Neurological, Metabolic and Geriatric Sciences, Second University of Naples, Italy.
11) Department of Medicine, Geriatrics Division, University of Verona, Italy.
12) Department of Geriatrics, Neurosciences and Orthopaedics, Catholic University of the Sacred Heart, Rome, Italy.

*Members of the GLISTEN Study Group and their affiliations in Supplementary Appendix section.

**Corresponding author**:
Luca Agosta, MD
Department of Medical Science, University of Torino - C. Bramante, 88 - 10126 Torino, ITALY.
e-mail: lucagosta@yahoo.it
Phone: +39 011 6336660
Mobile: +39 333 1520773
ORCID: 0000-0002-8360-7742

**Abstract**

**Background**: recently the Berlin Aging Study II (BASE-II) showed that polypharmacy is associated with clinically relevant sarcopenia among community-dwelling older persons. Here we report findings from the GLISTEN study about the association of polypharmacy with sarcopenia among older medical in-patients.

**Methods**: the GLISTEN study investigated prevalence and clinical correlates of sarcopenia in older patients admitted to geriatric and internal medicine acute care wards of 12 Italian hospitals.

**Results**: in this sample of older medical in-patients with high prevalence of sarcopenia (34.7%) and polypharmacy (70.2%) we did not observe a significant association of polypharmacy with sarcopenia.

**Conclusions**: present findings demonstrate that the association of polypharmacy with sarcopenia, observed in the BASE-II study, is not evident in the GLISTEN sample, being our patients significantly older, more multi-morbid, with high prevalence of sarcopenia and polypharmacy, suggesting that this association might vary according to the heterogeneous health, functional and nutritional characteristics of older people.

**KEY WORDS**: inpatients, polypharmacy, skeletal muscle, sarcopenia.

**Dear Editor,**

Sarcopenia usually occurs as a result of multiple predisposing factors, including age-associated physiological changes, chronic diseases, nutritional deficiencies and low physical activity [1]. Results from the Berlin Aging Study II (BASE-II) recently showed that polypharmacy, which is highly prevalent in elderly people, is associated with higher likelihood of being affected by sarcopenia among community-dwelling older persons [2]. Here we examined the association of polypharmacy with sarcopenia among older medical in-patients enrolled in the GLISTEN (Gruppo di Lavoro Italiano Sarcopenia – Trattamento e Nutrizione; Italian working group on sarcopenia – nutrition and treatment) study. The GLISTEN study investigated prevalence and clinical correlates of sarcopenia in older patients admitted to geriatric and internal medicine acute care wards of 12 Italian hospitals [3]. Sarcopenia was defined as the presence of low muscle mass, plus low muscle strength, or low physical performance, according to the European Working Group on Sarcopenia in Older People definition and diagnostic algorithm [3]; muscle mass, strength and function were measured by bio-impedance analysis (BIA), hand-grip strength and 4 meters walking speed [3]. A comprehensive geriatric assessment including basic functional status, cognitive performance, depression, and comorbidity was performed in each patient [3]. The total number of medications daily taken by each patient before admission was recorded: the use of five or more drugs and ten or more drugs daily were defined as polypharmacy and hyper-polypharmacy, respectively.

Among the 655 patients enrolled (mean age 81.0 ± 6.8 years, 51.9% women), sarcopenia was found in 227 (34.7%) subjects, and it was significantly associated with older age, male gender, low body mass index, history of congestive heart failure, previous stroke, and severe impairment in activities of daily living [3]. The mean number of medications taken before admission was 6 ± 2.9, with 460 patients (70.2%) using 5 or more drugs daily and 85 (13%) patients taking 10 or more drugs daily. Mean number of drugs daily taken (6.0±2.7 vs 6.0±3.0, p=0.83) and prevalence of polypharmacy (59.9% vs 53%, p=0.12) and hyper-polypharmacy (12.3% vs 13.3%, p=0.81) did not differ in patients with and without sarcopenia. In multivariate analysis (including the variables significantly associated with sarcopenia as older age, male gender, low body mass index, history of congestive

heart failure, previous stroke, and severe impairment in activities of daily living), using the Cox regression model with equal times at risk and robust variance to estimate prevalence ratio (PR) neither polypharmacy (PR 1.20; 95% CI 0.96-1.49) nor hyper-polypharmacy (PR 0.97; 95% CI 0.70-1.35) were significantly associated with presence of sarcopenia.

Although our sample size was not large enough to detect difference in prevalence less than 5%, these data are different than those from the BASE-II, in which polypharmacy was found to be associated with a twofold increased likelihood of sarcopenia among community-dwelling subjects [2].

How can the present findings from the GLISTEN study be harmonized with those of the BASE-II study? This latter study was conducted on community-dwelling subjects using a different assessment of sarcopenia: body composition was evaluated by dual-energy X-ray absorptiometry (DXA) instead of BIA and lean mass was identified by ALM/BMI-cutoffs as proposed by the FNIH Sarcopenia Project [2]. The use of BIA presents some drawbacks mainly due to hydration problems frequently observed in older persons that may result in underestimation of body fat and overestimation of fat-free mass. Although in previous studies [4] BIA has shown a tendency to overestimate muscle mass when compared to DXA, our patients had a greater prevalence of sarcopenia.

In BASE-II mean age of enrolled patients was of 68 years, with a median number of 2 drugs daily and only 21% of subjects receiving polypharmacy [2]. In our sample patients were older (mean age 81 years), had greater prevalence of polypharmacy (70.2%) and sarcopenia (34.7%), and a median number of 6 drugs daily. In a similar vein, these patients had greater prevalence and severity of diseases, with poor nutritional and functional status, thereby diluting the potential clinical impact of polypharmacy. In the GLISTEN study advanced age, diseases (previous stroke, congestive heart failure) and poor functional status, were significantly associated with increased prevalence of sarcopenia. Although polypharmacy has been demonstrated to be a risk factor for recurrent hospitalizations among older patients, there is scant evidence of association of polypharmacy with sarcopenia among older medical in-patients, and in a previous study we did not document an association between polypharmacy and functional decline in hospitalized older patients [5].

In conclusion, the association sarcopenia-polypharmacy is not evident in our sample of Italian hospitalized patients, being on average significantly older, more multi-morbid, with both a high prevalence of polypharmacy and sarcopenia, whereas in the younger and healthier BASE-II sample, with lower prevalence of polypharmacy and sarcopenia, there was clear evidence of an association. Further studies on large sample of patients might contribute to shed some light on this association.

**Funding**

No funding has been received for this study.

**Compliance with ethical standards**

Author consent: all authors consent for the final accepted version of the manuscript to be considered for publication in Age and Ageing journal.

Disclaimer: this manuscript reports work that has not been reported in large part in a published article or is contained in or closely related to another paper that has been submitted or accepted for publication elsewhere.

Informed consent: informed consent was obtained from all individual participants included in the study. Conflict of interest: the authors declare that they have no conflict of interest.

Ethical approval: all procedures performed in studies involving human were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

**References**


1. Fielding RA, Vellas B, Evans WJ, et al. Sarcopenia: an undiagnosed condition in older adults. Current consensus definition: prevalence, etiology, and consequences. International working group on sarcopenia. J Am Med Dir Assoc. 2011;12:249–256.
2. König M, Spira D, Demuth I, Steinhagen-Thiessen E, Norman K. Polypharmacy as a Risk Factor for Clinically Relevant Sarcopenia: Results From the Berlin Aging Study II. J Gerontol A Biol Sci Med Sci, 2017, Vol. 73, 117-122.
3. Bianchi L, Abete P, Bellelli, G Bo M, Cherubini A, Corica F, Di Bari M, Maggio M, Manca GM, Rizzo MR, Rossi A, Landi V, Volpato S for the GLISTEN Group Investigators. Prevalence and Clinical Correlates of Sarcopenia, Identified According to the EWGSOP Definition and Diagnostic Algorithm, in Hospitalized Older People: The GLISTEN Study. J Gerontol A Biol Sci Med Sci, 2017, Vol. 72, 1575–1581.
4. Reiss J, Iglseder B, Kreutzer M, Weilbuchner I, Treschnitzer W, Kässmann H, Pirich C, Reiter R. Case finding for sarcopenia in geriatric inpatients: performance of bioimpedance analysis in comparison to dual X-ray absorptiometry. BMC Geriatr, 2016; 16:52.
5. Isaia G, Maero B, Gatti A, Neirotti M, Aimonino-Ricauda N, Bo M, Ruatta C, Gariglio F, Miceli C, Corsinovi L, Fissore L, Marchetto C, Zanocchi M. Risk factors of functional decline during hospitalization for the oldest old. Aging Clin Exp Res, 2009; 21: 453-457.

GLISTEN Study Group Investigators:

*Gloria Brombo, Beatrice Ortolani, Elisabetta Savino, Elisa Maietti*: Department of Medical Science, University of Ferrara, Ferrara, Italy.

*Alberto Fisichella, Valeria Buttò*: Department of Clinical and Experimental Medicine, Geriatric Rehabilitation Department, University of Parma, Parma, Italy.

*Mauro Zamboni, Cesare Caliari, Elena Ferrari*: Department of Medicine, Section of Geriatrics, University of Verona, Verona, Italy.

*Francesco Orso, Flavia Sacco, Maria Laura DI Meo*: Research Unit of Medicine of Aging, Department of Experimental and Clinical Medicine, University of Florence, Florence, Italy. Geriatric Intensive Care Unit, Department of Geriatrics and Medicine, Azienda Ospedaliero-Univesitaria Careggi, Florence, Italy.

*Anna Paola Cerri, Marco Motta, Francesca Pittella, Alessandra Bonfanti*: Department of Health Sciences, University of Milano Bicocca, Milano, Italy. Acute Geriatric Unit, S. Gerardo Hospital, Monza, Italy.

*Sergio Fusco, Valeria Prestipino Giarritta, Luca Soraci*: Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy.

*Fausto Giordano Pili*: Dipartimento di Scienze Mediche, SCDU Geriatria e Malattie Metaboliche dell'Osso, Città della Salute e della Scienza, Molinette, Torino, Italy.

*Claudia Basile*: Department of Translational Medical Sciences, University of Naples Federico II, Naples, Italy.

*Carla Coppola, Anna Maria Dalise, Ilaria Fava*: Dipartimento di Scienze Mediche, Chirurgiche, Neurologiche, Metaboliche e dell'Invecchiamento, Seconda Università di Napoli, Napoli, Italia.

*Olga Catte, Maura Orrù, Paolo Salaris*: UOC di Geriatria Ospedale SS. Trinità ASL 8 Cagliari.

*Anna Maria Martone, Elena Ortolani, Sara Salini*: Department of Geriatrics, Neurosciences and Orthopaedics, Catholic University of the Sacred Heart, Rome, Italy.

*Giuseppina dell'Aquila, Barbara Carrier*: Geriatrics and Geriatrics Emergency Care, Italian National Research Center on Aging (IRCCS-INRCA), Ancona, Italy.