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1 **The older patient with cardiovascular disease: background and clinical implications of the**
2 **comprehensive geriatric assessment (CGA)**
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27 Key words: geriatric assessment, preoperative evaluation, intensity of care, prognosis
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30 **Abstract**

31 Principles and processes of Comprehensive Geriatric Assessment (CGA) are increasingly being
32 applied to subspecialties and subspecialty conditions, including cardiovascular patients (i.e. infective
33 endocarditis; considerations of surgery or transcatheter aortic valve replacement, TAVR, for patients
34 with aortic stenosis; vascular surgery) and postoperative mortality risk.
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37 In cardiovascular field CGA has mainly the aim to define ideal management according to the different
38 typology of older adult patients (eg, robust versus intermediate versus physical and cognitively
39 disabled versus end-stage or dying), allowing physicians to select different therapeutic goals
40 according to life expectancy; Aspect to be valued are by CGA are global health status and patient’s
41 decision-making capacity: CGA allows the individualized treatment definition and optimize the pre-
42 procedure condition.
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49 **Introduction**

50 In cardiovascular field Comprehensive Geriatric Assessment (CGA) has mainly the aim to define
51 ideal management according to the different typology of older adult patients (eg, robust versus
52 intermediate versus physical and cognitively disabled versus end-stage or dying), allowing physicians
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1 to select different therapeutic goals according to life expectancy. Data have shown that the “real
2 patient” is different from the “trial patient”; in fact the latter, even if old, is usually in good general
3 condition, without comorbidities and cognitive and physical impairments [1,2). This patient may be
4 considered a “robust” or an “intermediate” subject. In the real world, however, many patients are
5 frail, with severe comorbidities, polypharmacy, cognitive or physical disabilities, and reduced life
6 expectancy. Elderly patient are frequently frail: while practice guidelines are mainly for the robust
7 patient, real old patients are frail with reduced life expectancy: medical doctor should choose survival
8 and symptoms as outcomes of treatment in robust patients, but only symptoms in the frailest group
9 of patients [3].

10 CGA is defined as a multidisciplinary diagnostic and treatment process that identifies medical,
11 psychosocial, and functional limitations of a frail older person in order to develop a coordinated plan
12 to maximize overall health with aging. The health care of an older adult extends beyond the traditional
13 medical management of illness. It requires evaluation of multiple issues, including physical,
14 cognitive, affective, social, financial, environmental, and spiritual components that influence an older
15 adult's health. CGA is based on the premise that a systematic evaluation of frail, older persons by a
16 team of health professionals may identify a variety of treatable health problems and lead to better
17 health outcomes or non-medical problems (i.e. social vulnerability) that may negatively interfere with
18 the disease's trajectory [4-6].

19 Although the geriatric assessment is a diagnostic process, the term is often used to include both
20 evaluation and management. Geriatric assessment is sometimes used to refer to evaluation by the
21 individual clinician (usually a geriatrician) and at other times is used to refer to a more intensive
22 multidisciplinary program, also known as CGA. For this aim CGA is the inescapable tool [7-9].

37 **Comprehensive Geriatric Assessment**

38 Specific factors used by CGA programs to identify patients include:

39 ***a) Aging (systemic consequences of aging)***

- 40 1. Changes in body composition. Changes in body composition are the most evident effect of aging:
41 a) the decrease of so-called lean body mass; b) the increase of fat mass and c) the progressive
42 demineralization and architectural modification occur in bone. Such changes are also influenced by
43 lifestyles factors and diet).
 - 44 2. Balance between energy availability and energy demand. Overall elderly persons have low
45 available energy level and require more energy both at rest and during physical activity.
 - 46 3. Modification of the "network" that control homeostasis.
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1 4. Neurodegeneration phenomena reflected in the high prevalence of "soft" nonspecific neurologic
2 signs, such as slow and instable gait, poor balance, and slow reaction times. [10].
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5 6 **b) Comorbidity**

7 Comorbidity refers to pre-existing or coexisting distinct additional diseases with respect to the
8 "index" disease, i.e. the disease that causes a worsening of the state of health in an individual, and/or
9 the acute event or the disease that most affects the prognosis [11-15]. These additional pathologies
10 may be concordant (when they share the same risk factors; i.e. if the index pathology is a myocardial
11 infarction, concordant conditions may be hypertension and dyslipidemia) or co-occurring, but not
12 concordant (i.e. if the index condition is an arrhythmia co-occurring, but not concordant, pathologies
13 may be breast cancer or diverticulosis).
14

15 The comorbid diseases may have a variable and independent weight on survival (i.e. COPD, renal
16 cancer) or a variable weight on disability (i.e. polyarthritis, Parkinson's disease) or both.
17

18 The definition of co-morbidity represents an advancement in the understanding of the patient's
19 somatic health: when related to the possible co-presence of other diseases and their severity it allows
20 to define with less uncertainty the therapeutic possibilities, the impact on disability and the prognosis
21 of patient [3].
22

23 24 25 26 27 28 29 **c) Frailty**

30 It is a condition of reduced homeostatic efficiency after a stressful event and a consequence of the
31 cumulative decline in the course of life in many physiological systems linked to single pathologies
32 or, more frequently, multimorbidities, to their treatment, to lifestyles, to aging. Frailty is susceptibility
33 to breakage, damage, latent vulnerability, possible loss of adaptive capacity .
34

35 Two concepts of frailty are operatively used: 1) the "frailty phenotype" , which includes reduction of
36 muscle strength, fatigue, reduction of walking speed, weight loss (reduced lean mass) and reduced
37 physical activity [16] and 2) the deficit accumulation measured by the "frailty index", which includes
38 sensory deficits, disabilities and comorbidities, conditions that are considered related to fragility but
39 which in the same time constitute distinct entities [17].
40

41 The "frailty phenotype" gives information about the risk of developing disability, the Frailty Index
42 assessing the loss of basal or instrumental functions contributes in itself to the diagnosis of frailty.
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45 46 47 48 49 50 **d) Disability**

51 Disability is the personal condition of those who, following one or more impairments, is less
52 autonomous in carrying out daily activities and often in disadvantaged conditions in participating in
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1 social life. Disability in the elderly is the main consequence, the final common pathway of chronic
2 diseases and their combination.

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4 Disability is the impairment of the person's ability to perform autonomously (albeit with aids) the
5 activities of daily life [4].

6
7 Disability in the elderly is the final common pathway of chronic diseases and their combination.
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9 Disability can arise both acutely as a consequence of a pathology that has a significant impact on the
10 locomotor system (for example a stroke or a femur fracture) or when the clinical substrate is very
11 frail (for example pneumonia in a malnourished patient with severe comorbidity); it can also
12 progressively appear starting subclinically (characterized by the development of minimal functional
13 limitations, not yet such as to significantly interfere with function): this is the case of non-fatal clinical
14 conditions. The subclinical situation indicates a high risk of subsequent clinically manifest disability
15 [15, 18-20].

16
17 Functional assessment (of disability) is the main aspect of geriatric evaluation, it investigates the
18 ability to perform activities, from the simplest to the most complex, and to maintain a social role. In
19 relation to complexity and difficulty the activities of everyday life can be defined as "basic" (BADL:
20 Basic Activities of Daily Living), "instrumental" (IADL: Intermediate Activities of Daily Living) or
21 "advanced" (AADL: Advanced Activities of Daily Living)[4-5].

22
23 Disability can be objectively assessed by performance tests, and especially when they contain
24 quantitative assessments (i.e. time taken to complete a task or scores of scales, gait speed) show a
25 good sensitivity even in the detection of small functional changes, performance status are the more
26 appropriate tests for the integration of traditional evaluation in measuring the effects not only of
27 pharmacological treatments, but also of surgical procedures on organs or apparatuses not directly
28 related to motor function [18-19].

29 30 31 32 33 34 35 36 37 38 39 40 *e) Cognitive impairment*

41 The incidence of cognitive impairment increases with age, particularly among those over 85 years,
42 yet many patients with cognitive impairment remain undiagnosed. The value of making an early
43 diagnosis includes the possibility of uncovering treatable conditions. Dementia is a disorder
44 characterized by the decline in cognition involving one or more cognitive domains (learning and
45 memory, language, executive function, complex attention, perceptual-motor, social cognition). The
46 deficits must represent a decline from previous level of function and be severe enough to interfere
47 with daily function and independence.

48
49 Mild cognitive impairment (MCI) is an intermediate clinical state between normal cognition and
50 dementia [3-5].
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3 **f) Mood disorders**

4 Depressive illness in the elder population is a serious health concern leading to unnecessary suffering,
5 impaired functional status, increased mortality, and excessive use of health care resources.

6 Depressive symptomatology may be the psychic epiphenomenon of a general condition of
7 inadequacy, of psychological, physical, relational, socio-environmental incompetence. Chronic
8 diseases, chronic pain syndromes, recent changes in life and the presence of disadvantageous
9 conditions, the presence of poor health, and unexplained physical symptoms are associated with
10 depression [3-5].
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17 **g) Polypharmacy**

18 Older persons are often prescribed multiple medications by different health care providers, putting
19 them at increased risk for drug-drug interactions and adverse drug events. The clinician should review
20 the patient's medications at each visit. As health systems have moved towards electronic health
21 records and e-prescribing, the potential to detect potential medication errors and interactions has
22 increased substantially [4-5].
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29 **h) Geriatric syndromes and social vulnerability**

30 The complex condition is caused by the interaction of multiple genes and environmental factors. In
31 geriatrics it takes into account of the impact of morbidity burden and extra-clinical factors related to
32 health: sex, network and social support, availability of care, economic, ability to use services, etc.

33 Social vulnerability as assessed by network and social support affect the patient's health status and its
34 vital trajectory.
35

36 While age related systems changes, clusters of pathological conditions (comorbidity and
37 multimorbidity), syndromes (geriatric syndromes), frailty, disability, burden of diseases, network and
38 social support have been described individually, in reality they coexist, develop in parallel and
39 interfere with each other through feed-back and feed-forward loops: the phenotype of aging (the
40 characteristics of the patient) is the result of their interactions [13].
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CGA in older patient with cardiovascular diseases

The best evidence for comprehensive geriatric assessment (CGA) is based on identifying appropriate patients (ie, excluding patients who are either too well or are too sick to derive benefit). No criteria have been validated to readily identify patients who are likely to benefit from CGA.

Many of the principles of inpatient CGA consultation have been incorporated into comanagement programs [21-29]. As an example, comanagement with a geriatrician may reduce mortality, complications, delirium, and rehospitalization among patients with hip fracture on the surgical service. A meta-analysis of surgical comanagement demonstrated decreased length of stay and suggested the possibility of decreased inpatient mortality. In a second meta-analysis, CGA for persons with hip fracture provided as consultation or on an inpatient unit reduced the likelihood of being discharged to a setting where they would receive an increased level of care such as an assisted-living or long-term care facility compared with discharge home; although not significant, the meta-analysis suggested a benefit on inpatient mortality.

Principles and processes of CGA are increasingly being applied to subspecialties and subspecialty conditions, including cardiovascular patients (i.e. infective endocarditis; considerations of surgery or transcatheter aortic valve replacement (TAVR) for patients with aortic stenosis; vascular surgery) and postoperative mortality risk [2,19,21, 30].

For these patients aspect to be valued are: global health status, patient's decision-making capacity, treatment definition, assessment to optimize the pre-procedure condition

a) The health status of an elderly person influences outcomes.

Before any treatment of angioplasty, transcatheter aortic valve replacement cardiac or surgical procedure, it is necessary to define what the goals are, as well as the patient's expectations and priorities. One must also consider whether the patient's estimated life expectancy justifies the indication for the procedures and, if not, whether one should opt for alternative solutions. Very elderly patients with a theoretic procedure indication should undergo an assessment which includes the evaluation of comorbidities and of their geriatric conditions. The personalized strategies of optimization must focus not only on the biomedical outcomes, but also on the functional, cognitive, nutritional and social outcomes. When one is consulted about the indications for an intervention in an elderly patient (in order to obtain an informed consent), it is necessary that the patient know what the goals of the treatment are and understand the realistic probabilities of the surgical risk. A preoperative geriatric multidimensional assessment is the most advanced mode for ensuring that this communication is carried out in the most realistic way [31-33].

1 ***b) Evaluation of the decision-making capacity***

2 The capacity to make medical decisions includes the capacity to express a choice, the capacity to
3 understand the information related to that choice, and the capacity to understand the consequences of
4 a decision.
5

6 Aging is per se associated with a loss of cognitive functions and decision-making capacity. Even if it
7 is common to find an impaired decision-making capacity among very elderly patients, age is not the
8 only risk factor for neurocognitive disturbances such as dementia or delirium. Patients with moderate
9 to severe dementia are able to make only limited decisions while patients with mild cognitive deficit
10 or with minor psychiatric diseases may be able to make simple decisions [21].
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16 ***c) Defining the treatment***

17 For elderly or very elderly patients with multiple conditions for whom a surgical intervention is
18 theoretically indicated, the goal-oriented approach is preferable to the more traditional disease-
19 oriented approach.
20

21 The physician needs to help the patient define and formulate their personal expectations. In evaluating
22 a patient, the very first step should be to establish the general life goals of the patient.
23

24 The questions to put to the patient must be easy to understand. It is important to help patients express
25 any undeclared preoccupations they might have through the use of clear, unambiguous questions such
26 as “Is there anything in this phase of your life that has been really preoccupying you?”. All members
27 of the healthcare team can contribute to clarifying the goals and priorities of the patient. The priorities
28 once articulated can, however, change and they need to be reformulated (i.e. the patient needs to be
29 requested once again) each time a change is detected in the patient’s health status [26].
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36 Once the priority of the goals has been established, the feasibility of the procedure need to be
37 discussed. Some treatments are complex and burdensome. If the social support is not adequate, this
38 may preclude the possibility of a complex treatment. The prognosis must influence the choice of
39 treatment. Even if age is important in determining the chances of survival, multimorbidity and
40 functional impairment can strongly influence the overall prognosis several instruments for evaluating
41 the individualized perioperative risk are available. These tools are not specific for the elderly patient
42 and no single instrument incorporates specific geriatric parameters [30].
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49 ***d) Preoperative assessment and optimization of pre-surgical condition in very old patients***

50 When it has been established that surgery has more probability of yielding benefits than risks, the
51 next step is to identify the modifiable risk factors that might condition the outcomes of a procedure.
52 This assessment must include specific geriatric domains. In theory, specific evaluations are
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1 mandatory for all patients in the oldest old age-group who have an indication for surgery, bearing in
2 mind that older patients have a substantially greater risk of morbidity and mortality with respect to
3 younger patients, even for the less complex procedures [3-5].
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7 **Conclusions**

8
9 The complexity of the clinical problems of frail patients can never be solved in a single-specialist
10 way, but always requires a multi-disciplinary approach. The availability of defined elements can lead
11 to better decisions that will determine the quality of care and at the same time that there are elements
12 related to the professional who is treating each case [13,22].
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15 Today the complexity and dealing with new diagnostic and therapeutic tools require an improved set
16 of skills necessary to face all the different challenges, and therefore it is necessary to dialogue with
17 those who have more in-depth skills in other specialties and then to work as a team. The problems of
18 elderly patients are sometimes described using simplistic and inadequate paradigms, while geriatrics
19 has a precise and understandable glossary, which allows each team member to thoughts and
20 information that can be easily transmitted between team members. This approach is particularly
21 useful in medical areas where health is the result of biomedical, functional, social and relational
22 factors such as those dealing with aging and related diseases. If the concepts are clear, the information
23 can be communicated among the members of the care team and therefore the diagnostic communion
24 can be realized, furthermore the definition of the objectives and the tools to obtain them can be more
25 easily identified and shared [6-7).
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33 It is well known that frail older patients present a significant clinical challenge as a consequence of
34 polypharmacy, multimorbidity and presentations that have functional, psychological, social and
35 environmental dimensions that confuse simple monodisciplinary management. Comprehensive
36 geriatric assessment provides a multidimensional and multidisciplinary model of care. It generates
37 lists of problems and diagnoses, establishes goal-oriented management plans and ensures their
38 review, provides effective health care to vulnerable groups who otherwise would have received an
39 ineffective, inefficient and potentially dangerous response. The geriatric multi-dimensional approach
40 is evidence-based and has been shown to improve patient health outcomes. If enclosed in service
41 models and even specific clinical paths (such as those of cardiology, trauma, oncology), it could
42 greatly contribute to minimizing damage and ensuring that the right healthcare is practiced at the right
43 time.
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