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Optimizing preoperative assessment for dentoalveolar surgery in geriatric patients: The emerging role of CGA

Nyoman Ayu Anggayanti [1,*], Ni Made Ista Prestiyanti [2] and Putu Sinta Elix Wahyuni [3]

[1] *Oral and Maxillofacial Surgery Specialist, Department of Oral and Maxillofacial Surgery, Faculty of Medicine, Udayana University, Denpasar, Bali, Indonesia.*
[2] *Lecturer, Department of Oral and Maxillofacial Surgery, Faculty of Medicine, Udayana University, Denpasar, Bali, Indonesia.*
[3] *Clinical Student, Dentistry Profession Education Study Program, Faculty of Medicine, Udayana University.*

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Abstract

Introduction: The elderly have a high susceptibility to various active pathogens and are associated with multimorbidity. These conditions result in medical procedures, especially those that are invasive, having a much higher risk and complications, including dentoalveolar surgical procedures. This scientific review was prepared as a reference for pre-operative management in dentoalveolar surgery to support a safe and controlled intra- and post-operative experience for geriatric patients.

Literature review: This study used 30 studies in the last 10 years retrieved through Google scholar, PubMed, and Science Direct search engines with inclusion and exclusion criteria.

Discussion: Preoperative assessment, particularly comprehensive geriatric assessment (CGA), is crucial for successful surgical management in the elderly. Studies highlight CGA's role in reducing morbidity, mortality, and postoperative complications related to frailty across different surgeries. Dentoalveolar surgery in the elderly shows a high prevalence and risk, yet there are no established preoperative guidelines for its management. The key domains of CGA assessment have strong potential to prevent poor surgical outcomes after dentoalveolar surgery based on the similarities in complications, frailty, and morbidity that occur in various surgeries in the elderly.

Conclusion: CGA can be the gold standard in the management of dentoalveolar surgery in geriatric patients to provide excellent care and a comfortable post-operative experience for patients.

Keywords: Dentoalveolar; Surgery; Geriatric; Preoperative; Assessment

1. Introduction

Geriatrics is a medical specialty that focuses on the management of health and the treatment of diseases in older adults [1]. According to the Ministry of Health of the Republic of Indonesia, geriatric patients are defined as individuals aged 60 years and older, commonly referred to as elderly [2]. The European Union of Medical Specialists defines geriatric patients as individuals over 65 years of age who have a high susceptibility to various active pathologies and frequently experience multiple morbidities [3]. The World Health Organization (WHO) reported that the global prevalence of the older population in 2019 reached 13.4% and is estimated to reach 25.3% of the total population by 2050 [4]. In

* Corresponding author: Nyoman Ayu Anggayanti

Indonesia, the proportion of older adults reached 10.3% in 2020 and is projected to continue increasing, reaching 57.0 million people or 17.9% by 2045 [2].

Aging in older adults results due to a series of biological and physiological processes that result in decreased organ function in all body systems and is often associated with multimorbidity and frailty syndrome [5]. Older patients tend to have multimorbidity represented by multiple chronic diseases or geriatric conditions resulting from associated organ changes requiring multiple medical management. Special consideration is required when the elderly require care, due to limited life expectancy, complications or organ dysfunction. Multimorbidity causes poor health care-related outcomes, leading to increased health care use and costs [6]. Frailty syndrome in the elderly characterized by a decline in physical and cognitive functional abilities, as well as adaptation due to degradation of the function of various systems in the body, resulting in the elderly being more vulnerable to various kinds of stress. Vulnerable elderly have a higher risk of premature death and various poor health conditions, such as falls, broken bones, disability, dementia, weakness, fatigue, medical complexity, and reduced tolerance for medical and surgical interventions, which require special attention for elderly patients who will undergo surgical procedures [6, 7].

Dentoalveolar surgery is a surgical procedure in dentistry that involves teeth and supporting structures related to the oral cavity [8]. Dentoalveolar surgery constitutes more than 50% of all oral surgical procedures performed worldwide. Oral and maxillofacial surgeons (OMS) plays an important role in treating a large number of oral health conditions in the geriatric population, from extractions, implants, reconstruction, and cosmetic surgery to the management of head and neck pathologies [9]. Dentoalveolar surgical management is more invasive and riskier than other procedures in dentistry, especially in geriatric patients. This procedure is associated with conditions of decreased functional capacity, multimorbidity, cognitive dysfunction, vulnerability, post-surgical complications and, decreased ability to deal with stress experienced by geriatric patients after surgery [6, 7].

Surgical procedures in geriatrics involve holistic management which includes preoperative assessment for risk stratification, intraoperative, and postoperative [10]. Preoperative evaluation is a very important aspect in determining the success of surgery in the elderly. Preoperative assessment influences a better intraoperative process and improves desirable postoperative outcomes in geriatric patients. However, there are no specific guidelines regarding preoperative assessment of dentoalveolar surgery in geriatric patients [10, 11]. Therefore, This study was prepared as a reference for preoperative management with the aim of improving the experience during and after dentoalveolar surgery for geriatric patients to be safer and more controlled.

2. Literature review

The literature in this review was obtained through several search engines such as Google Scholar, Pubmed, and ScienceDirect with publication coverage in the last ten years. Key words in the search such as dentoalveolar, surgery, geriatric assessment, preoperative were used to ensure the relevance of the article to the review objectives. Article selection is carried out to assess the suitability of the topics discussed which includes reviewing the title, abstract and full text analysis.

Inclusion criteria include studies that discuss comprehensive geriatric assessment (CGA) in the context of dentoalveolar surgery or general surgery in the elderly, studies involving populations aged 60 years and over, studies that are available in full text, and studies with clear methodology. Exclusion criteria included studies that only discussed CGA in a non-surgical context, studies that focused on surgical aspects without CGA as a major factor, and non-scientific publications. After the screening and evaluation stages, 30 articles were selected for further analysis. The curated articles were then evaluated qualitatively and synthesized in a discussion to explore the role of CGA in improving the safety and success of dentoalveolar surgery in elderly patients.

3. Results

A total of 30 studies were reviewed to identify the role and impact of preoperative evaluation strategies in geriatric patients undergoing surgery. Although the primary focus of this review was on dentoalveolar surgery, the lack of specific preoperative guidelines in this area necessitated the exploration of data from other types of surgery that have similar risk profiles and postoperative challenges in the elderly population.

These studies' various preoperative evaluation techniques were examined, paying special attention to the CGA application.

Table 1 Results of the literature review

Researcher, location, & year	Study type	Surgery	Sample Size	Age	Assessment	Objective	Findings
McIsaac DI, Canada, 2017	*RC*	Elective	266	≥ 65	*CGA*	Determine the relationship between preoperative geriatric evaluation and postoperative outcomes.	The 90-day survival was longer compared with subjects who did not undergo geriatric evaluation.
Shahrokni A, New York, 2019	*RC*	Oncogeriatrics	980	≥ 75	*CGA, Anesthesiologists Physical Status (ASA)*	Assess the correlation between ASA classification and deficits *CGA.*	CGA deficits were strongly associated with 6-month mortality, while ASA classification showed no significant correlation. CGA provides critical information for improving postoperative outcome prediction in oncogeriatric patients.
Tarazona-Santabalbina, Spain, 2019	*RC*	Colorectal	310	77 ± 4	*CGA, usual care (UC)*	Evaluate the impact of the CGA approach on patients undergoing colorectal surgery.	*CGA* interventions resulted in a lower incidence of delirium and other geriatric syndromes compared with the group *UC.*
Penning, Belgium, 2022	*RC*	Abdominal	112	≥ 70	G8 screening tool followed by CGA.	Evaluate the relationship between the G8 and *CGA*.	G8 and CGA may be predictive factors for postoperative complications in oncogeriatric patients.
Adogwa O, Texas, 2017	*RC*	Neuro	125	≥ 65	*CGA*	Determine whether preoperative and perioperative management by a geriatric specialist reduces in-hospital complications and length of stay	*Geriatric comanagement* reduces the incidence of postoperative complications, shortens the duration of hospital stay, and contributes to improving perioperative functional status.
Chang SY, Republic of Korea, 2020	*PC*	Lumbar Spinal Stenosis	261	≥ 65	*CGA*	Evaluate the predictive value of *CGA* for early complications	Frailty based *CGA* is significantly associated with common complications early after surgery.

Kong C, China, 2022	*PC*	Orthopedic	214	75–100	*CGA*	Assess the overall condition of elderly patients undergoing orthopedic surgery and identify risk factors for postoperative complications using CGA strategies.	*CGA* reducing patient mortality and improving safety in older orthopedic surgery patients.
Chen D, China, 2019	*PC*	Elective	551	≥ 65	*CGA (Mini-Cog testing)*	Assessing preoperative mini cog testing in predicting postoperative mortality	*Mini cog* can be used to identify geriatric patients at risk of increased mortality one year after elective surgery
Lee YH, Korea, 2016	*PC*	Colorectal Cancer	240	76.7 ± 5.2	*CGA*	Identifying the effectiveness of assessments CGA pre-operative use in predicting post-operative morbidity.	*CGA* preoperative indications of "high risk" were associated with major postoperative complications in elderly patients undergoing colorectal cancer surgery
De Vries, Netherlands, 2019	*PC*	Head and Neck Malignancy	151	78.9	*CGA*	Evaluate the value of geriatric assessment in relation to postoperative complications.	Frailty is the strongest predictor of postoperative complications in patients undergoing surgery for head and neck malignancies
Mokutani Y, Japan, 2016	*PC*	Colorectal Cancer	156	≥ 75	*CGA*	Determine whether CGA can predict complications in colorectal cancer surgery and identify associated risk factors.	*CGA* is a useful predictor of postoperative complications in elderly patients.
Sentí S, Spain, 2021	*PC*	Colorectal Cancer	227	≥ 75	*CGA*	Analyze postoperative outcomes in colorectal cancer surgery based on comprehensive geriatric evaluation results.	*CGA* using different scales is a good tool to assess post-surgical mortality in the mid-term post-surgical period.
Abete P, Italy, 2016,	*PC*	*Elective*	396	≥ 65	*CGA*	Verify whether *CGA* may improve prediction of morbidity and mortality in elderly patients undergoing surgical intervention.	Elective surgery in elderly patients has low morbidity and mortality. CGA enhances identification of high-risk patients for adverse events, independent of the surgical prognostic index

Kenig J, Poland, 2015	*PC*	*Abdominal cancer*	75	≥ 65	*CGA*	Compare frailty prevalence based on the number of CGA domains included and evaluate its accuracy in predicting postoperative outcomes.	Number of domains *CGA* integration has a major influence on prevalence *frailty* and adequate surgical risk assessment
Sánchez-Garcia L, *Spain*, 2021	*PC*	Aortic	144	> 60	*CGA*	Evaluate the impact of systematic geriatric preoperative assessment.	*CGA* is a valid tool to estimate the life expectancy and physiological status of patients.
Antonio M, Spain, 2018	*PC*	Nonsmall-cell lung cancer (NSCLC)	85	≥ 75	*CGA*	Determine the prognostic value of *CGA* and its ability to predict toxicity	CGA identifies elderly patients with localized NSCLC who are unsuitable for surgery but suitable for cCRT, with satisfactory survival and toxicity outcomes.
McDonald SR, North Carolina, 2018	*PC*	Abdominal	326	75 ± 6	*CGA*	Evaluate clinical outcomes of older adults undergoing elective abdominal surgery through collaborative interventions in surgery, geriatrics, and anesthesia aimed at perioperative health optimization.	Despite older age and higher morbidity burden, elderly patients participating in interdisciplinary perioperative care interventions experience fewer complications, shorter hospital stays, higher discharge rates to home, and lower readmission rates compared to the control group.
Giannotti C, Italy, 2019	PS	Colorectal	99	≥ 65	Frailty Index (FI) and CGA	Evaluate the diagnostic accuracy of the 40-item Frailty Index (FI) compared to CGA in predicting one-year mortality and functional status after colorectal surgery.	Consistent and both serve as interrelated markers of clinical vulnerability.
Couderc AL, France, 2020	PS	Hip and knee arthroplasty	1004	≥ 65	Mini CGA	Identify simplified standardized geriatric assessment (mini CGA) criteria associated with unplanned hospital	CGA-assessed ADL dependence increased risk in older patients undergoing planned arthroplasty, while preoperative independent living was linked to higher

						admission within 3 months after planned hip/knee arthroplasty	complications within three months postoperatively.
Korc-Grodzicki B, New York, 2015	*RR*	Oncogeriatrics	416	≥ 65	*Geriatric assessment (GA)*	Describe the implementation of preoperative geriatric assessment (GA) in patients undergoing major cancer surgery and identify predictors of postoperative delirium.	Preoperative GA is feasible and may provide a better understanding of perioperative risks in elderly patients, including delirium.
Shi Min Chau C, Singapore,2023	*CSS*	Vascular	65	≥ 65	*CGA*	Assess the impact of the CGA-based Geriatric Consultation Service on medical outcomes in elderly vascular surgery patients.	Supports the use of preoperative CGA which shows a decrease in length of stay and a decrease in the rate of postoperative intensive care.
Sourdet S, France, 2020	*CSS*	Oncogeriatrics	480	82.8 ± 5.5	*CGA*	Identify CGA domains associated with changes in cancer treatment plans.	Cognition, malnutrition, and low physical performance were significantly associated with changes in cancer treatment plans in oncogeriatrics.
Rodrigues M, Brazil, 2019	*CSS*	Allogeneic hematopoietic stem cell transplantation	61	60–76	CGA	Evaluate CGA assessment outcomes before allogeneic hematopoietic stem cell transplantation.	CGA is feasible to use to detect patient susceptibility in the population.
Zhu T, China, 2022	*RCT*	Hip fracture	155	≥ 65	*CGA*	Identify the influence *CGA* in the perioperative period of hip fracture.	Implementation *CGA* shorten the preoperative waiting time and total hospital stay, increase the rate of surgery within 48 hours, and reduce the incidence of postoperative delirium.
Partridge JS, London, 2017	*RCT*	Vascular	176	≥ 65	*CGA*	Evaluate the effects *CGA* post-operative vascular surgery.	*CGA* Preoperative treatment is associated with a shorter length of stay.

Lee JY, Korea, 2020	*RDS*	Spinal	133	≥ 65	CGA	Determine the relationship between CGA subcomponents and hospital length of stay in elderly patients undergoing spinal surgery.	Attention to the subcomponents of depression and frailty and their interactions to improve the health status of elderly surgical patients.
Paille M, Paris, 2021	RM	Cardiac	407	≥ 75	*CGA*	Analyze the relationship between preoperative CGA and hospital le.ngth of stay.	Supports systematic preoperative use of CGA. Preoperative CGA reduces the length of stay compared to without CGA.
Partridge JS, *Netherlands,* 2017	*Pre-intervention Post-intervention study design*	Colorectal cancer	224	≥ 75	*CGA (rehab care included training, dietary, cognitive, & emotional guidance)*	Evaluate the effectiveness of a multimodal treatment program for elderly CRC patients undergoing curative surgery.	Multidisciplinary care, including pre-rehabilitation and rehabilitation, is feasible for elderly CRC patients and may reduce complications and hospital stay. However, no clear benefits were found from a comprehensive care program, with dedicated multidisciplinary care being the key factor in positive surgical outcomes.
Braude P*, 2017, London*	*Before-after study*	Elective	242	≥ 65	*CGA*	Evaluate the impact of implementing POPS-Urology structured geriatric liaison services using the CGA methodology in urology inpatients.	A multidisciplinary system enhances collaboration between the surgical and geriatric medicine teams. GSCL enables the systematic identification of patients requiring a focused CGA.

Keterangan (RC = Retrospective cohort, RM = Retrospective monocentric, PC = Prospective cohort, RR = Retrospective review, PS = Prospective study, RDS = Retrospective,descriptive study, CSS = Cross-sectional study,RCT = randomized control trial)

The above table summarizes the results and lists each study's attributes, such as study type, surgical domain, patient demographics, evaluation techniques, and reported clinical outcomes. These data provide an initial overview of the potential benefits and challenges of implementing CGA and other approaches in the context of surgical care in geriatric patients.

4. Discussion

Aging results in a progressive decline in general function resulting in a loss of adaptive responses to stress and an increased risk of disease. This functional decline occurs at the molecular level due to mutations in DNA, RNA, and proteins, along with errors intranscription (RNA) and translation (protein). Additionally, increased reactive oxygen species (ROS), primarily produced by mitochondria during aging, contribute to cellular damage. Mitochondrial DNA can also be influenced by ROS and affects mitochondrial function including production adenosin triphosphate (ATP) [12, 13]. The visible impact of this process on the elderly is often associated with increased vulnerability and loss of resistance to external stress (frailty syndrome). This condition results in an increased risk of adverse postoperative outcomes and predisposes to poor surgical outcomes, including in dentoalveolar surgery [14, 15].

Older adults represent the largest group undergoing surgical procedures, including oral surgery. Oncology cases are closely related to surgical management, of which 2/3 occur in elderly patients [16]. Saravani et al. (2016) conducted an epidemiological study of oral lesions in elderly people over the age of 60 years and showed that malignant lesions dominated with detailed 42.5% of the sample identified as squamous cell carcinoma, 7,8% non-specific inflammatory lesions, 3,4% irritation fibroma, and 3.4% oral verrucous carcinoma [17]. Other research conducted by Carvalho et al. (2015) related to geriatric dentoalveolar surgery, the prevalence of maxillofacial trauma in the elderly reached 16.8%. Findings from other studies indicate that the most frequently occurring types of maxillofacial trauma were fractures of the alveolar bone 46.5%, soft tissue injuries 37.8%, and dental injuries 13.4% [18, 19]. These data show the urgency of surgery accompanied by the high risk of surgery in the dentoalveolar plane of geriatric patients. However, no standardized guidelines exist for planning dentoalveolar surgery specifically in the geriatric population [16, 19].

Preoperative risk assessment and identification is the most important initial step for better implementation and outcomes before surgical treatment. A literature review of surgical interventions for geriatric patients shows better postoperative outcomes due to preoperative intervention with the specificity of the CGA preoperative method dominating the finding [11, 16, 20-47]. CGA is a form of multidimensional preoperative assessment diagnostic and therapeutic to determine the medical, psychological, functional capabilities of the elderly, develop a coordinated and integrated treatment plan and follow-up [48]. This process does not simply assess a specific medical condition but rather involves a holistic assessment using objective tools and multidisciplinary interventions to optimize all aspects of the assessment, assess risks, and direct the benefits of surgery in alignment with goals [46]. CGA plays a role in risk stratification with seven main assessment domains including communication status, physical, mobility, mental, nutritional, social support, and medical status [49]. Communication status is seen through the ability to express, see, hear, understand the information given, physical status is assessed from internal independence activities of daily living (ADLs) And instrumental activities of daily living (IADLs), Mobility status includes fine and gross motor skills, mental status includes memory and cognitive abilities, nutritional status includes conditions of malnutrition and dehydration, social support status is the ability to engage needed assistance, and medical status is related to the ability to medically tolerate procedures [49, 50, 51].

Components of CGA assessment has been considered as a valid tool in estimating life expectancy and physiological status of geriatric patients in geriatric surgical procedures [20, 37]. McIsaac et al. (2017) in their study to determine the relationship of CGA with postoperative outcomes of elective surgery in the elderly showing a better survival rate during the 90day postoperative period compared to the group without intervention [11]. This is consistent to the findings of Abete et al. (2016) and Chen et al. (2019) on a similar type of surgery that also verified the domain significance CGA in reducing post-operative morbidity and mortality rates [29, 40]. CGA strategy applied in a prospective cohort study by Kong et al. (2022) also showed a reduction in mortality in elderly patients undergoing orthopedic surgery [28]. GCA based interventions also showed a significantly reduced rate of post-surgical complications and length of stay [39, 41]. The results of studies with various designs and types of surgery show the accuracy of susceptibility predictions (frailty) which is good with CGA proportional to frailty index. Chang et al. (2020) states that frailty is strongly associated with various kinds of post-treatment complications (delirium, geriatric syndrome, malnutrition and lower physical performance) which can prolong the postoperative hospital stay [22, 35, 41].

The implementation of CGA in the context of dentoalveolar surgery for geriatric patients is essential to identify and manage potential complications, morbidity, mortality and post-surgical length of stay [11, 16, 20-47]. This is due to post-surgical complications, such as delirium, which have a high incidence in elderly patients. Ishibashi et al. (2020)

conducted a study on delirium following major surgical interventions for oral tumors and reported that 33.3% of patients experienced postoperative delirium. Delirium is a serious complication and usually occurs in major surgery, especially in the elderly. The high prevalence of delirium occurs in patients over 65 years of age and increases by 2% every year. Delirium occurs in 15% to 50% of major surgeries in elderly patients and is associated with post-surgical complications, prolonged hospitalization, poor functional recovery, dementia, and increased mortality [52]. CGA has been proven to reduce the incidence of postoperative delirium in several specific studies that examined its effect on the incidence of postoperative delirium. These findings support the urgency of cognitive domains, nutrition, physical activity, preoperative medical status as significant predictors of the risk of developing postoperative delirium [16, 32, 38]. Other studies in the dentoalveolar field that evaluated morbidity after third molar removal in the elderly showed a much greater and worse morbidity rate. The complication rate for removing third molars in the elderly reaches 22%, with details of intraoperative complications reaching 7.9% and postoperative complications reaching 16.5%, while in young people the visible complications are only 3.1% [53]. Lack of domain CGA leads to higher morbidity and complications after surgery which is associated with the identification of weakness (frailty). Identification frailty in geriatrics during pre-operation with main domain coverage CGA can help determine the development of complications, incidence of morbidity and potential risk factors for unplanned hospitalization [22, 35, 41].

Based on a review of 30 journals in this study, CGA was generally found to significantly reduce morbidity, mortality, complications, and length of stay across various surgical procedures. CGA was also found to be a valid predictor of frailty in the elderly that impacts adverse outcomes during and after surgical treatment [37]. This is due to its role in not only predicting and diagnosing but also providing therapeutic guidance, enabling individualized multidisciplinary optimization for vulnerable patients undergoing surgery [46]. CGA becomes an ideal model to implement in the field of dentoalveolar surgery for geriatric patients based on the complication risk characteristic equation approach, frailty, and surgical morbidity varies in diverse surgeries [11, 16, 20-47]. Therefore, considering the high prevalence of geriatric patients in oral surgery and the absence of a standardized preoperative management model, integrating CGA into clinical practice is a crucial step toward optimizing outcomes and minimizing complications. Its implementation can enhance patient-centered care, improve surgical preparedness, and ultimately contribute to better postoperative recovery in elderly patients.

5. Conclusion

The results of the literature review conducted shows the importance of appropriate preoperative management in elderly patients, including in the context of dentoalveolar surgery. The substantial increase in the need for dentoalveolar surgical procedures in the elderly population and the high risks involved, highlight the shortcomings in the existence of consistent planning guidelines. CGA has been recognized as the gold standard which can be relied upon in the preoperative holistic assessment of the elderly population undergoing various types of surgery. The similarity in risks of complications, morbidity, frailty, and even mortality between dentoalveolar surgery and other surgical procedures highlights the urgency and relevance of using CGA as a systematic guidance tool. Therefore, implementation of CGA in clinical practice could be a crucial step in ensuring optimal management and safety of geriatric patients undergoing dentoalveolar surgery.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare that there is no conflict of interest related to the publication of this manuscript.

Statement of ethical approval

This study did not involve the conduct of experiments or direct data collection on animals or human subjects by the authors.

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