

Geriatric Cyclists: Assessing Risks, Safety, and Benefits

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Abstract

Nearly 1 in every 3 Americans ride bicycles each year, but only 20% of the reported 100 million cyclists ride on a weekly basis. Bicycling is a common form of transportation and recreation and has gained popularity among the elderly patients. In recent years, the number of elderly cyclists has increased steadily and studies have cited ease of use, need for exercise, and enjoyment as important contributing factors. The benefits of physical activity on health is well-documented, and elderly individuals are encouraged to remain active to reduce the progression of age-related weakness and loss of muscle mass. Safety concerns, however, have been a prevalent public health issue. According to the Center for Disease Control and Prevention, elderly and teenage cyclists account for the highest number of head injuries and fatalities among all cyclists. Safety measures that include wearing protective gear such as helmets and choosing the appropriate bicycle have been recommended to minimize the risk of sustaining injuries while riding. Despite these concerns, bicycling has remained a popular and exciting activity for the elderly patients.

Keywords

geriatric medicine, geriatric trauma, physical medicine and rehabilitation, fragility fractures, physical therapy

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Introduction

The population is aging, and increased susceptibility to falls is a common hallmark of aging.¹ Some contributing factors include age-related muscle weakness, deteriorating vision, and gait instability, which ultimately result in deteriorated balance.¹ More than 30% of elderly individuals fall at least once a year and may sustain serious injuries such as fractures, with a 20% mortality rate at 1 year.¹ According to the Center for Disease Control and Prevention, over 900 cyclists were killed in the United States in 2013 in addition to nearly 500 000 emergency visits due to bicycle-related injuries.² Physical activity is recommended to reduce age-related musculoskeletal decline, improve strength and balance, and combat declining mental status.³ Among these activities, bicycling has gained popularity among the elderly patients.^{3,4} Benefits include strengthening muscle groups used in maintaining balance and strength (ie, quadriceps), enjoyment, autonomy, and improved cardiovascular function.⁴ The ease of use has also contributed to popularity among the elderly patients. However, bicycle users are also prone to cycling-related injuries that have been documented.⁵ Cyclists are at risk of collisions involving motor vehicles, often due to unawareness of surrounding.⁶ Common

cycling-related injuries can be categorized into acute trauma or overuse injuries. Acute trauma may involve both upper and lower extremities, head, and thoracoabdominal injuries.⁷ Fractures involving the wrist and hands are common, and head trauma that manifests in the form of concussions, contusions, and intracranial hemorrhage is seen as well.⁷ Overuse injuries can involve strains and dislocation of joints such as the knees and ankles.⁷ In 2015, the US Department of Transportation reported 45 000 bicycle-related injuries with 818 fatalities.⁸ Although the number of fatalities has decreased over time, the importance of implementing safety measures while cycling has remained an essential to keeping cyclists safe.^{2,8}

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Table 1. Risk factors and problems associated with cycling among the elderly.

Risks Factors Associated With Elderly Cycling	Potential Problems
Poor vision	Increased nighttime falls Difficulty observing traffic Difficulty reading signs and poor adaptability to changing traffic conditions
Reduced muscle strength	Poor balance Increased falls due to instability Inability to properly operate bicycle
Declining cognition	Poor judgment Increased chances of getting lost Inability to comprehend traffic signs, signals, and warnings

There are several contributing factors associated with increased risks involved with cycling among elderly patients. However, given the extensive scope of that endeavor, the goal of this article is to address a few of those problems. These include visual, strength, and cognition-related issues (Table 1). Moreover, we will provide recommendations for cycling in addition to addressing safety factors to optimize bicycling for elders interested, or already involved in the activity.

Elderly Cycling: Age-Related Risks

Individuals within the geriatric community may have decreased peripheral vision, coordination, and balance, as well as reduced cognitive function and judgment.^{9,10} Musculoskeletal changes associated with aging such as sarcopenia, osteopenia, and osteoporosis increase the risk of weakness, instability, and fracture.¹¹⁻¹³ Although research supports the notion that cycling is a healthy modality to increase fitness and reduce cardiovascular risk factors, the elderly community is at a greater risk for injury due to anatomical and physiologic changes associated with aging.¹⁴

Kiburz et al surveyed 492 active adult cyclists and found that 46% had been involved in accidents, with the individual cyclist and turns being responsible for 58.7% and 22.9% of the crashes, respectively.¹⁵ These numbers may be expected to be greater if applied to elderly cyclists. Due to the previously mentioned modifications associated with senescence, it may prove difficult for the elderly patients to simultaneously maintain balance, exert force, and display swift decision-making while bicycling.

Morbidity and Mortality

Cycling injuries produce significant morbidity and mortality.⁶ In the general population, cycling-related mortalities are most commonly caused by head injuries secondary to collisions with motor vehicles.^{6,16} Risk of neck injury and prolonged hospital admission are also increased by bicycle-motor

vehicle collisions.¹⁶ It is estimated that the use of a proper helmet could prevent up to approximately 85% of cycling fatalities caused by head injuries.¹⁷ Despite this notion, helmet use is disappointingly low among the community.^{16,17} The most frequent mechanisms of injury in elderly cyclists include falls from getting on or off the bicycle, irregularities in the ground, such as potholes or edges of sidewalks, and accidents involving automobiles.¹⁸

Sparse data are available in the literature to discern specific injuries suffered by the elderly patients while cycling. Luo et al reviewed 192 patients aged >65 with femoral intertrochanteric fractures and found that 55 (29%) patients suffered this injury secondary to falling while riding a bicycle.¹⁸ Clavicular fractures are common in the bicycling community.^{18,19} Nowak et al studied the etiology and epidemiology of clavicular fractures and concluded the most common activity resulting in fracture was cycling.²⁰ Nonunion is a rare complication of these fractures and can result in shoulder dysfunction. Robinson et al deduced that the rate of nonunion following clavicular fractures is significantly increased with advancing age.²¹ Although many young patients undergo surgical management, the elderly patients are often treated nonoperatively.^{22,23}

In regard to chronic injury, common overuse injuries in cyclists result in anterior knee pain and patellofemoral pain syndrome (PFPS).^{23,24,25} In these patients, biomechanical abnormalities should be assessed via evaluation of the vastus medialis, hip abductors, and foot pronation, as these factors may play a role in the development of PFPS. For mild cases, patients make adjustments to the bicycle fit and ensure the exercise intensity and distance are appropriate.²⁶⁻²⁹ Stationary cycling is a suitable alternative for aerobic exercise during rehabilitation. Recommending quadriceps, hamstring, and ilio-tibial band stretches and exercises may reduce symptoms via decreasing the stress at the patellofemoral joint.³⁰ Cases of ulnar neuropathy have been reported in elderly bicyclists, as cyclers are at risk of compression of the ulnar tunnel via the handlebars.³¹ Long-distance cycling may also exacerbate symptoms associated with carpal tunnel syndrome.³² Nonoperative treatment includes non-steroidal anti-inflammatory drugs (NSAIDs) and wrist splinting. For refractory neuropathies, operative management yields optimal results.^{33,34}

Recommendations

Optimizing benefits and minimizing risks are important to enjoying cycling as an elderly individual. Safety measures of cycling must be taken at all times to reduce the incidence of sustaining debilitating injuries while cycling (Table 2). Studies have shown evidence of brain “shrinkage” associated with advanced age.^{5,35} As a result, wearing appropriate helmets has been a long-standing recommendation to reduce head-related injuries and fatalities. However, data are scarce regarding which specific type of helmet to wear for elderly patients. Although all helmets offer protection, it is our opinion that properly fitted helmet will best protect the cyclist from loose head movements that may contribute to head injuries upon impact.

Table 2. Safety concerns and potential interventions.

Safety Concerns	What Can Be Done
Weather conditions	Avoid riding in the snow, rain, or windy conditions in addition to cycling at night
Road conditions	Avoid riding in areas with high traffic Ride in bike lanes, paths, or low-traffic areas Try to avoid areas with rough pavements and potholes to avoid potential falls
Type of bicycles	Conventional bicycles are preferred to pedelecs
Bicycle safety/ checklist	Ensure tires have adequate pressure (avoid riding with flat tires), make sure mounts are low, facilitate getting on/off bicycle. Wear helmets at all times, ensure that helmets are fitted to head size

Vision checks are particularly important as well, given the age-related visual decline associated with the elderly patients.³⁶ Annual vision checks are important to ensure proper vision.³⁷ The decision to halt outdoor cycling with noticeable deterioration can be made both by the individual's primary care physician or family members.³⁶ In the same regard, annual physical examinations should assess muscle strength to permit or refuse cycling at the physician's discretion. In these examinations, paying attention to footwear is vital. Loose or poor-fitting footwear can be associated with increased risks of falls and sustaining injuries.³⁶⁻³⁸ The incidence of mental decline usually correlates with increased age. Cognitive assessments during yearly physical examinations are equally important to determining the level of "fitness" to perform cycling activities.³⁶ Issues such as getting lost frequently, forgetting addresses, or difficulty adapting to traffic conditions should warrant immediate assessments.³⁶

Types of bicycles also play a role in safety of the cyclist. In a study done by Twisk et al, it was found that pedelecs (bicycles with electric component) were associated with higher injury risks than conventional bicycles.³⁹ These bicycles, though good for riding up hills due to the ability to generate greater speeds, may be more difficult to control and therefore can be unsafe.³⁹ Bicycles with lower mounts are safer than those with higher mounts, as it fosters ease of mounting and unmounting.³⁹ Other minor recommendations such as ensuring adequate tire pressures and having effective breaks are helpful.

Outdoor cycling, though enjoyable, is associated with ancillary risk factors that may pose safety hazards. The weather and road conditions pose unfavorable conditions to cycling. For example, heavy winds, rain, snow, and nighttime riding should be avoided when cycling to reduce risk of falls and other injuries.^{36,40,41} In these conditions, stationary bikes should be considered as they have been shown to reduce falls especially in elderly women.⁴² Moreover, biking-friendly infrastructure that includes having dedicated biking lanes decreases risk of sustaining traffic-related injuries due to decreased traffic, more space for bikers, and safely allocated

space for maneuvering.^{40,43} Installation of bicycle lanes has also been shown to be helpful, and communities with installed bike lanes are generally safer.⁴⁴

Literature is scarce regarding specific recommendations for those who should not be allowed to cycle. However, recommendations based on results from annual physical examination should provide an adequate assessment. Furthermore, it is our opinion that elderly individuals with physical impairments, recent injuries, notable cognitive decline, or those requiring assistance with activities of daily living should not be allowed to cycle without further assessment.⁴⁵

Limitations

Although there is a rich supply of literature explaining the risks and benefits of cycling within the general community, limited data depict the additional risk the elderly patients are subjected to during cycling.⁴⁶ The majority of studies focused on geriatric cycling were conducted in Europe.^{8,18,46} Thus, to properly evaluate the elderly population from a global perspective, additional data are needed from countries with different climates, such as varying terrain and traffic trends.

Conclusion

Recent strides in geriatric wellness have contributed to the stable increase in individuals living beyond the age of 65. Studies predict that by 2040, almost 20% of the American population will consist of those >65 years old.¹ Bicycling is on the rise and injuries are as well.²⁹ Geriatric cyclists are more likely to suffer injury and negative sequelae than others.²⁷ Furthermore, geriatric cyclists are approximately 3× more likely to suffer fatal accidents than the average cyclist.²⁷ Benefits of bicycling include increased cardiovascular function, muscle strength, and flexibility and improved coordination and posture. However, Olmedillas et al reported that biking may not be ideal for bone health as bikers have generally shown lower bone mass than nonbikers.⁴⁷ Therefore, other weight-bearing exercises, including walking, should be encouraged to preserve bone mass. Overall, bicycling should be encouraged in elderly individuals under safe conditions, given the several benefits it provides. To that end, safety measures should be followed at all times while cycling to avoid potential debilitating injuries.

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