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REVIEW

Ankle fractures in the elderly: risks and management challenges

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Abstract: Ankle fractures are the third most common osseous injury in the elderly, behind hip and distal radius fractures. While there is a rich history of clinical advancement in the timing, technique, perioperative management, and associated risks of hip fractures, similar evaluations are only more recently being undertaken for ankle fractures. Traditionally, elderly patients were treated more conservatively; however, nonoperative management has been found to be associated with increased mortality. As such, older and less healthy patients have become operative candidates. The benefits of geriatric/orthopedic inpatient comanagement that have been well elucidated in the hip fracture literature also seem to improve outcomes in elderly patients with ankle fractures. One of the orthopedist's roles is to recognize the complexities of osteoporotic bone fixation and optimize wound healing potential. Though the immediate cost of this surgical approach is inevitably higher, the ultimate cost of long-term care has been found to be substantially reduced. It is important to consider the mortality and morbidity benefits and cost reductions of operative intervention and proper inpatient care of geriatric ankle fractures when they present to the emergency department or the office.

Keywords: ankle fractures, geriatrics, trauma, outcomes, management, surgery

Introduction

The elderly population represents a rapidly growing segment of our nation's population. Advancements in technology and medicine have allowed health care professionals to provide better and effective care, thus increasing the life expectancy of the elderly. According to data collected from the Centers for Disease Control and Prevention (CDC), there has been a steady annual rise in the life expectancy of Americans, with life expectancy currently at 78.7 years.[1] Americans 65 years and older currently account for ~15% of our nation's population. This proportion has been rising each year, and it is estimated that the elderly will account for a fifth of our nation's population by 2050.[2] Although elderly patients are most commonly hospitalized for medical conditions, orthopedic injuries often result in hospital admission.[3] Geriatric patients frequently present with orthopedic injuries as the result of falls. It is estimated that one out of every three elderly individuals experiences at least one fall annually. Furthermore, ~20% of these falls result in serious injuries, such as fractures.[4] While hip fractures remain the most common fracture seen in the elderly patient population, ankle fractures are the third most prevalent fractures seen in this patient population.[5] It is estimated that 8.3 per 1,000 Medicare recipients sustain an ankle fracture each year.[6]

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As the aging population continues to grow larger and older, the incidence and prevalence of geriatric ankle fractures will likely also increase.

The orthopedic management of a geriatric patient is complicated by several factors. Elderly patients often present with multiple medical conditions that make surgical management challenging and place them at an increased risk for both perioperative and postsurgical complications. Data collected from Medicare estimate that approximately a quarter of all patients above the age of 65 years had at least four or more chronic health problems.[7] To that extent, patients admitted for ankle fractures are significantly older, have comorbidities such as hypertension, and more often require a computed tomography (CT) scan, possibly consistent with greater degrees of fracture comminution in osteopenic bone.[1] An important part of the recovery process after an orthopedic procedure is rehabilitation. Unfortunately, many elderly patients already have poor health reserves and struggle with the strenuous rehabilitation required. In addition, they often do not have the social support structure to return home and resume their activities of daily living without significant assistance. Many require placement in nursing homes or assisted living facilities, and several studies have documented increased mortality and morbidity associated with nursing home admission after hospitalization for orthopedic injuries.[8,9] As such, geriatric ankle fractures represent a management challenge for orthopedic surgeons, and careful consideration of risks associated with surgery must be considered when determining optimal treatment.

Management considerations

It is important to understand that ankle fractures in the elderly have several unique aspects when compared to hip fractures and distal radius fractures, the other two most common orthopedic injuries encountered in this age group. Unlike many fractures in the elderly, studies suggest that low-energy ankle fractures in the elderly are not the result of their inevitably weaker bones but rather their predisposition to falls and a worsening obesity epidemic.[10] A study comparing elderly women who sustained ankle fractures to those who did not found that there was no difference in bone mineral density measured using dual-energy X-ray absorptiometry (DEXA) scans between the two patient cohorts.[11] This is supported by the work by Seeley et al[12] that examined a cohort of >9,000 elderly females and found no correlation between bone mineral density and ankle fractures. Though osteoporosis does not increase the risk of these fractures, the fixation and healing outcomes of these weaker bones are typically different than those of a younger patient.[13] Several studies have documented increased weight as a risk factor for geriatric ankle fractures, which is unique compared with hip and distal radius fractures.[13] This increased body mass index (BMI) may also correlate with other risk factors for increased perisurgical risk such as diabetes mellitus.

There is still considerable debate as to the optimal management of a geriatric patient who presents with an ankle fracture – regardless of the fracture pattern. While unstable ankle fractures are often almost always treated surgically in younger patients, the presence of comorbidities and the fear of complications induce hesitation among surgeons. A study examining a large cohort of >30,000 Medicare patients with ankle fractures found that the presence of comorbidities such as diabetes, peripheral vascular disease, and older age was associated with nonoperative treatment.[14] Interestingly, the study also noted variation in the management of geriatric ankle fractures across the United States and that certain areas of the country have higher rates of operative intervention.[14] This geographic variation in management is unique to geriatric ankle fractures; it is not seen in hip fractures.[14] The study hypothesized that variations in injury energy vary by geography; alternative possibilities include institutional fracture management training variations – with regional retention of trainees, differing concentrations of teaching versus community hospitals (teaching hospitals more commonly treated ankle fractures nonoperatively), or regional differences in geriatric frailty guiding different treatment plans.

There is a vast amount of literature on the management of geriatric ankle fractures with studies supporting both operative and nonoperative treatments. Salai et al[15] prospectively assigned 84 elderly patients with ankle fractures to either operative or nonoperative treatment after a successfully closed reduced ankle fracture, and they found that the American Orthopaedic Foot and Ankle Society (AOFAS) scores (a survey assessing patient-reported pain, function, and gross joint alignment) were higher in the nonoperative group and increased costs were associated with operative treatment. However, it is important to note that in their study, patients who failed closed reduction were treated operatively, suggesting that the operative group may already consist of more severe injuries, thus predisposing them to inferior AOFAS scores. In contrast, Makwana et al[16] conducted a prospective study comparing operative versus nonoperative management of patients 55 years and older who sustained displaced ankle fractures and found that operative intervention resulted in improved functional outcomes and better range of motion, even after a successful closed reduction. Another retrospective study examining early outcomes after operative fixation

of geriatric ankle fractures also reported good functional outcomes with >85% of their patients returning to their pre-injury mobility.[17] In further support of operative management, Koval et al found that nonoperative management of geriatric ankle fractures was associated with increased mortality, though operative management was associated with increased hospital readmissions. Their study did not find a significant difference in postoperative complications between the two groups.[18] The reportedly increased mortality associated with nonoperative management of geriatric ankle fractures is further supported by a recent assessment of 19,000 Medicare patients who were hospitalized with ankle fractures. The investigators discovered that there was approximately a two-fold increased mortality rate with nonoperative management, even after controlling for the presence of comorbidities.[19] It has been postulated that factors other than the surgery itself may be providing some of the surgical benefits seen, such as improved rehabilitation and mobilization following surgery.

As previously discussed, the orthopedic geriatric patient presents with several complicating factors when considering treatment options; while several studies documented decreased mortality and improved functional outcomes with surgery, it is important to consider the individual patient when discussing care. A careful discussion must be had with the patient and family regarding realistic outcomes, and comorbidities must be taken into account when discussing surgical risks.

Geriatric and orthopedic comanagement

Like the striking majority of hip fracture patients, ankle fracture patients requiring admission are typically older than 65 years, have medical comorbidities, and have fracture patterns requiring CT evaluation that may indicate comminution in weaker bone.[1] A systematic review of the geriatrics–orthopedics comanagement approach to geriatric patients with hip fractures has demonstrated benefits in both morbidity and mortality.[20] Pre- and postoperative comanagement focuses on thrombosis prevention, metabolic homeostasis, comorbidity treatment, mental status stabilization, and pain control, as well as identification of risk factors for nursing home/inpatient rehabilitation requirement.[20] Much of the comanagement of these patients is guided by the evidence that shows that medical optimization and expeditious operative intervention of hip fractures reduce mortality.[21] As a downstream effect, older patients have become operative candidates; even operative outcomes in the nonagenarian population are being evaluated.[22] Given a trend of longer hospital stays in the elderly hip fracture hospital population, and inevitably more complex medical conditions, geriatric hospitalist comanagement plays a crucial role in minimizing mortality in these patients.[20,22]

While not as profound as hip fractures, nearly 12% of patients admitted for ankle fractures experience mortality within 1 year.[23,24] This rate of mortality increases with increasing age, such as hip fractures. On average, patients requiring inpatient admission after ankle fracture are older and sicker than those who do not; 60% will ultimately require nursing home admission.[24] As these patients were discharged from hospitals to nursing homes, they had increased incidence of perioperative complications such as local infection and medical complications such as pneumonia, congestive heart failure exacerbation, myocardial infarction, and hollow-viscus bleeding.[24] Interestingly, a study examining the impact of disposition after geriatric ankle fractures found that after controlling for comorbidities, nursing home admission alone did not increase mortality. In addition, when controlling for comorbidities, operative intervention is thought to decrease mortality associated with isolated geriatric ankle fracture.[19] As such, it can be expected that older patients with more medical illnesses would be considered for operative intervention of ankle fractures to benefit the patient's overall mortality.

Hip fractures are certainly very different from ankle fractures and carry greater mortality risks when discussing treatment; however, outcomes after either injury are greatly impacted by comorbidities and the immobility associated with these injuries can exacerbate existing comorbid medical conditions. Given the successes of comanaging patients with hip fractures to enable successful surgical intervention, extending the practice to the similar ankle fracture population is the next sensible step. In a retrospective review of low-energy open ankle fractures in patients aged >60 years, 81% of patients had at least three significant medical comorbidities.[25] The ultimate goal of ankle fracture treatment is to return the function of the ankle, restore ambulation and activity capacities, and decrease the innate risks of prolonged immobilization.[10] While appropriate orthopedic management of ankle fractures is inherent to all three goals, they are equally unattainable without concentrating on medical conditions. For example, a hemoglobin A1c >7 increases postinjury risk of complications; medical management by physicians familiar with improving diabetes treatment regimens is recommended.[10] As falls are the most common mechanism of low-energy ankle fractures in the elderly, an etiology should be identified and targeted to facilitate rehabilitation, as well as decrease risk of future fall-associated fractures.[26] This

can include correcting electrolyte imbalances; identifying myopathic, cardiac, neurologic, or vestibular conditions; detecting sensory deficits that challenge safe ambulation; and reconciling polypharmacy. Patients can be evaluated for lifestyle changes and pharmacologic interventions to lower BMI, as a contributor to improved overall health and lowering the threshold for successful rehabilitation. Geriatricians and orthopedists can also work together to manage conditions that do not necessarily predispose an elderly patient to ankle fracture but that can improve global physical and mental health to promote an easier path to fracture recovery. Because of the mortality benefits of surgical management of ankle fractures in the elderly, it is critical that these patients receive suitable surgical and medical care to also reduce morbidity as they transition to nursing homes and/or their preinjury life. While the mortality of nonoperative management of ankle fractures does not rival that of hip fractures, there still are clear morbidity and mortality benefits to operative intervention of ankle fractures that must be considered when discussing treatment.

Fixation techniques

Once the decision to proceed with surgical management of a geriatric ankle fracture is made, there are several considerations for operative planning. While the fracture pattern often dictates the appropriate construct, one must account for the unique features of a geriatric ankle fracture. Osteoporosis affects ~200 million women worldwide and is responsible for ~9 million fractures annually.[27] Osteoporosis results in both quantitative and qualitative defects in bony mineralization, leading to weaker bone that is susceptible to inadequate fixation. Locking plates are fixed-angle constructs that can provide increased stability and minimize risk of screw pull out. A cadaveric study looking at a distal fibula fixation found that a locking plate construct is biomechanically superior to standard plates in osteoporotic bone.[28] Intramedullary fixation allows for smaller incisions that may be beneficial in decreasing complications such as wound breakdown and infection in at-risk geriatric patients. A prospective randomized study evaluating plate versus intramedullary fixation of fibula fractures in elderly patients with displaced ankle fractures found that patients with intramedullary fixation had better functional results compared to those with plate fixation.[29] Tibiotalocalcaneal (TTC) fusion eliminates ankle–hindfoot motion but can be a viable treatment option for low functioning patients with osteoporotic bone, as it can provide significant pain relief and early weight bearing.[30] Furthermore, TTC nails, like intramedullary fixation devices, can be placed with small incisions, decreasing the aforementioned risks of wound complications. A retrospective study evaluating the use of TTC nails in 31 elderly ankle fractures found that patients treated with TTC nails had good functional outcomes with nearly all patients returning to their pre-injury mobility level.[31] External fixator constructs are useful options in patients with open ankle fractures and/or compromised skin to facilitate soft tissue monitoring and eliminate the need for surgical incisions.[32] However, these systems are bulky, can prevent mobility, and can result in pin site infections. Ultimately, there are a number of treatment options that give the surgeon a wealth of options based on each patient's bone stock, wound complication risk factors, and functional status.

Costs/economics

In addition to understanding the individual complexities of patient-related outcomes in the geriatric ankle fracture population, one must also appreciate the costs associated with different treatment options. As previously mentioned, the geriatric population is expanding rapidly, and politicians, law makers, and health care providers are beginning to feel the effects of the growing numbers and improvements in life expectancy. Our current US health care economy is overstretched, and there is an emphasis on cost-effective care.[33] Medicare cost analyses dating back to 2011 have found large spending disparities among the elderly. Specifically, beneficiaries aged 80 years and older comprised 24% of the traditional Medicare population, and 33% of the total Medicare budget was spent on these patients in this age range. In contrast, beneficiaries between ages 65 and 69 years comprised 26% of the traditional Medicare population, but only 15% of the Medicare budget was spent on this age group.[34] While there is a wealth of literature detailing costs of management associated with various orthopedic problems such as geriatric hip fractures, the data are somewhat sparse with regard to cost-effective management of geriatric ankle fractures.

A study examining the reimbursement of ankle fracture admissions following operative or nonoperative management and costs associated with readmissions using a database of all 2008 Medicare Part A claims found that there was no difference in hospital stay regardless of treatment. As expected, they found a $3,500 increase in initial hospital cost with operative ankle fracture patients given surgical costs. The total readmission rate was found to be 29.7%; however, an important finding was that patients treated nonoperatively had a statistically significant 2.5% higher readmission rate than those patients who had surgery. From a cost analysis standpoint, this was significant since it was found that the average hospital readmission cost was ~$5,100. Extrapolated across

all claims, Medicare paid nearly $30 million in readmission costs, which is ~20% of the total cost of initial hospital admissions for geriatric ankle fractures.[33]

Regardless of treatment modality, there is a large cost associated with geriatric ankle fractures. Given that it is estimated that one in every five Medicare patients will be readmitted within 30 days of discharge, it is easy to see how readmissions alone can yield substantial health care demand.[35,36] Therefore, now more than ever, it is important for the treating surgeon to be aware of cost-effective management of geriatric ankle fractures in order to provide optimum and individualized care while minimizing risks and likelihood of hospital readmission.

Conclusion

The steady rise in the elderly population will result in more geriatric patients seeking treatment from health care providers. The management of geriatric orthopedic injuries is complicated due to the presence of challenging social situations, poor health reserves, and comorbidities. While literature on the management of geriatric hip fractures continues to blossom, newer evidence is demonstrating parallels between hip and ankle fractures. There continues to be debate as to the optimal management of displaced geriatric ankle fractures, and there are data to support both operative and nonoperative treatments. The orthopedic surgeon must consider the patient's individual risk factors and social and functional status when determining the optimal treatment. Regardless of treatment route, it is clear that early involvement of the patient's primary care physician or geriatric specialist is vital to reduce the risk of undue medical complications. The geriatric patient population is growing, and it is clear that there are several medical, economic, and social factors that must be considered when treating these patients for ankle fractures and other orthopedic injuries. Orthopedic providers will undoubtedly see more geriatric ankle fractures as the geriatric population continues to grow, and comprehensive management of the surgical and medical challenges associated with geriatric ankle fractures will improve patient care and outcomes.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Centers for Disease Control and Prevention [webpage on the Internet]. Life Expectancy, c2016. Atlanta: National Center for Health Statistics, Centers for Disease and Control Prevention [cited November 29, 2016]. Available from: https://www.cdc.gov/nchs/fastats/life-expectancy.htm. Accessed March 31, 2017.
2. U.S. Department of Health and Human Services [webpage on the Internet]. Administration of Aging (AoA): Projected Future Growth of the Older Population, c2014. Washington DC: Administration for Community Living [cited November 9, 2014]. Available from: http://www.aoa.gov/Aging_Statistics/future_growth/future_growth.aspx. Accessed March 31, 2017.
3. Russo CA, Elixhauser A. Hospitalizations in the Elderly Population, 2003. Statistical Brief #6. Rockville, MD: Agency for Healthcare Research and Quality; 2006 [cited November 9, 2014]. Available from: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb6.pdf. Accessed March 31, 2017.
4. Centers for Disease and Control Prevention [webpage on the Internet]. Home and Recreational Safety. Older Adult Falls: Get the Facts, c2014. Atlanta: Centers for Disease and Control Prevention [cited November 9, 2014]. Available from: http://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html. Accessed March 31, 2017.
5. Sporer SM, Weinstein JN, Koval KJ. The geographic incidence and treatment variation of common fractures of elderly patients. *J Am Acad Orthop Surg*. 2006;14(4):246–255.
6. Lynde MJ, Sautter T, Hamilton GA, Schuberth JM. Complications after open reduction and internal fixation of ankle fractures in the elderly. *Foot Ankle Sug*. 2012;18(2):103–107.
7. Karlamangla A, Tinetti M, Guralnik J, Studenski S, Wetle T, Reuben D. Comorbidity in older adults: nosology of impairment, diseases, and conditions. *J Gerontol A Biol Sci Med Sci*. 2007;62(3):296–300.
8. Neuman MD, Silber JH, Magaziner JS, Passarella MA, Metha S, Werner RM. Survival and functional outcomes after hip fracture among nursing home residents. *JAMA Intern Med*. 2014;174(8):1273–1280.
9. Bin SA, Fithian DC, Paxton LW, Khatod MX, Inacio MC, Namba RS. Does discharge disposition after primary total joint arthroplasty affect readmission rates? *J Arthroplasty*. 2010;25(1):114–117.
10. Mears SC, Kates SL. A guide to improving the care of patients with fragility fractures, edition 2. *Geriatr Orthop Surg Rehabil*. 2015;6(2):58–120.
11. Greenfield DM, Estell R. Risk factors for ankle fracture. *Osteoporos Int*. 2001;12(2):97–103.
12. Seeley DG, Kelsey J, Jergas M, Nevitt MC. Predictors of ankle and foot fractures in older women. The Study of Osteoporotic Fractures Research Group. *J Bone Miner Res*. 1996;11(9):1347–1355.
13. Strauss EJ, Egol KA. The management of ankle fractures in the elderly. *Injury*. 2007;38(suppl 3):S2–S9.
14. Koval KJ, Lurie J, Zhou W, et al. Ankle fractures in the elderly: what you get depends on where you live and who you see. *J Orthop Trauma*. 2005;19(9):635–639.
15. Salai M, Dudkiewicz I, Novikov I, Amit Y, Chechick A. The epidemic of ankle fractures in the elderly – is surgical treatment warranted? *Arch Orthop Trauma Surg*. 2000;120(9):511–513.
16. Makwana NK, Bhowal B, Harper WM, Hui AW. Conservative versus operative treatment for displaced ankle fractures in patients over 55 years of age. A prospective, randomised study. *J Bone Joint Surg Br*. 2001;83(4):525–528.
17. Srinivasan CM, Moran CG. Internal fixation of ankle fractures in the very elderly. *Injury*. 2001;32(7):559–563.
18. Koval KJ, Zhou W, Sparks MJ, Cantu RV, Hecht P, Lurie J. Complications after ankle fracture in elderly patients. *Foot Ankle Int*. 2007;28(12):1249–1255.
19. Bariteau JT, Hsu RY, Mor V, Lee Y, DiGiovanni CW, Hayda R. Operative versus nonoperative treatment of geriatric ankle fractures: a Medicare Part A claims database analysis. *Foot Ankle Int*. 2015;36(6):648–655.
20. Martinez-Reig M, Ahmad L, Duque G. The orthogeriatrics model of care: systematic review of predictors of institutionalization and mortality in post-hip fracture patients and evidence for interventions. *J Am Med Dir Assoc*. 2012;13(9):770–777.
21. Steinberg EL, Sternheim A, Kadar A, Sagi Y, Sherer Y, Chechik O. Early operative intervention is associated with better patient survival in patients with intracapsular femur fractures but not extracapsular fractures. *J Arthroplasty*. 2014;29(5):1072–1075.

22. van de Kerkhove MP, Antheunis PS, Luitse JS, Goslings JC. Hip fractures in nonagenarians: perioperative mortality and survival. *Injury*. 2008;39(2):244–248.
23. Hsu RY, Lee Y, Hayda R, DiGiovanni CW, Mor V, Bariteau JT. Morbidity and mortality associated with geriatric ankle fractures: a Medicare Part A claims database analysis. *J Bone Joint Surg Am*. 2015;97(21):1748–1755.
24. Kadakia RJ, Hsu RY, Hayda R, Lee Y, Bariteau JT. Evaluation of one-year mortality after geriatric ankle fractures in patients admitted to nursing homes. *Injury*. 2015;46(10):2010–2015.
25. Toole WP, Elliott M, Hankins D, Rosenbaum C, Harris A, Perkins C. Are low-energy open ankle fractures in the elderly the new geriatric hip fracture? *J Foot Ankle Surg*. 2015;54(2):203–206.
26. Schwartz AV, Nevitt MC, Brown BW Jr, Kelsey JL. Increased falling as a risk factor for fracture among older women: the study of osteoporotic fractures. *Am J Epidemiol*. 2005;161(2):180–185.
27. International Osteoporosis Foundation [webpage on the Internet]. Facts and Statistics, c2016. Switzerland [cited December 3, 2016]. Available from: https://www.iofbonehealth.org/facts-statistics. Accessed March 31, 2017.
28. Kim T, Ayturk UM, Haskell A, Miclau T, Puttilitz CM. Fixation of osteoporotic distal fibula fractures: a biomechanical comparison of locking versus conventional plates. *J Foot Ankle Surg*. 2007;46(1):2–6.
29. Pritchett JW. Rush rods versus plate osteosyntheses for unstable ankle fractures in the elderly. *Orthop Rev*. 1993;22(6):691–696.
30. Remmelt S. Management of ankle fractures in the elderly. *EFFORT Open Rev*. 2016;1:239–246.
31. Jonas SC, Young AF, Curwen CH, McCann PA. Functional outcome following tibio-talar-calcaneal nailing for unstable osteoporotic ankle fractures. *Injury*. 2013;44(7):994–997.
32. Andruszkow H, Pfeifer R, Horst K, Hildebrand F, Pape HC. External fixation in elderly. *Injury*. 2015;46(suppl 3):S7–S12.
33. Kadakia RJ, Ahearn BM, Tenenbaum S, Bariteau JT. Costs associated with geriatric ankle fractures. *Foot and Ankle Spec*. 2017;10(1):26–30.
34. Neuman T, Cubanski J, Huang J, Damico A. *The Rising Cost of Living Longer: Analysis of Medicare Spending by Age for Beneficiaries in Traditional Medicare*. Menlo Park, CA: The Henry J. Foundation; 2015.
35. Gerhart G, Yemane A, Hickman P, Oelschlaeger A, Rollins E, Brennan N. Medicare readmission rates showed a meaningful decline in 2012. *Medicare Medicaid Res Rev*. 2013;3(2):mmrr.003.02.b01.
36. Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care: advantages and limitations. *Arch Intern Med*. 2000;160(8):1074–1081.