

10.

Bölüm

MALLEOL KIRIKLARI

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GİRİŞ

Ayak bileği kırıkları sonucu ciddi ağrı ve yaşamsal aktivitelerde kısıtlılık meydana gelmektedir (1). Ayak bileği kırıkları bimodal dağılım göstermektedir. Genç yaşta yüksek enerjili yaralanmalar sonucu gelişirken ileri yaşlarda düşük enerjili yaralanmalar sonucu görülmektedir. Bimalleoler ve trimalleoler kırıklar daha çok ileri yaş kadın hastalarda sık görülmektedir (2). Epidemiyolojik çalışmalar ileri yaş aktif nüfusun artması nedeni ile malleoller kırık insidansının arttığını göstermektedir (3). Malleol kırıkları alt ekstremitelerde kırıklarının %9'unu oluşturmaktadır (4). Yapılan araştırmalar sonucunda hastaneye yatış gerektiren kırıklara bakıldığında ikinci en sık neden olduğu ortaya konulmuştur. Yıllar içerisinde malleol kırıkları nedeni ile yatış süreleri giderek kısalmaktadır (5). Çeşitli araştırmalara bakıldığında ayak bileği malleol kırık insidansı 100000'de 71-183 hasta/yıl olarak değişmektedir (6-8). Çoklu malleol kırıkları ileri yaş kadın hastalarda daha sık karşımıza çıkmaktadır (9). İleri yaş kadın hastalarda ayak bileği kırıkları risk faktörleri arasında aşırı kilo, nörolojik hastalıklar, sigara, çoklu ilaç kullanımı yer almaktadır (10). El bileği, omurga ve kalça kırıklarının gelişmesinde osteoporoz suçlanırken, ayak bileği malleol kırıkları gelişmesinde osteoporozis risk faktörleri arasında yer almamaktadır (11). Ayak bileği artrozlarının %39'u malleol kırığı sonucu gelişmektedir (12).

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bileği artroskopisi altın standarttır. Ayakbileği kırığı sonrasında gelişen ileri seviye artrozlar için ayak bileği füzyonu tedavi seçenekleri arasındadır (92).

KAYNAKLAR

- 1: McPhail SM, Dunstan J, Canning J, et al. Life impact of ankle fractures: qualitative analysis of patient and clinician experiences. *BMC musculoskeletal disorders*, 2012;13(1), 224.
- 2: Lee KM, Chung CY, Kwon SS, et al. Ankle fractures have features of an osteoporotic fracture. *Osteoporosis International*, 2013;24(11), 2819-2825.
- 3: Court-Brown CM, Duckworth AD, Clement ND, et al. Fractures in older adults. A view of the future?. *Injury*, 2018;49(12), 2161-2166.
- 4: Lash N, Horne G, Fielden J, et al. Ankle fractures: functional and lifestyle outcomes at 2 years. *ANZ journal of surgery*, 2002;72(10), 724-730.
- 5: Somersalo A, Paloneva J, Kautiainen H, et al. Incidence of fractures requiring inpatient care. *Acta orthopaedica*, 2014;85(5), 525-530.
- 6: Court-Brown CM, McBirnie J, Wilson G. Adult ankle fractures—an increasing problem?. *Acta orthopaedica Scandinavica*, 1998;69(1), 43-47.
- 7: Jensen M, Steen L. Epidemiology of ankle fractures: a prospective population-based study of 212 cases in Aalborg, Denmark. *Acta Orthopaedica Scandinavica*, 1998, 69.1: 48-50.
- 8: Elsoe R, Ostgaard SE, Larsen P. Population-based epidemiology of 9767 ankle fractures. *Foot and Ankle Surgery*, 2018;24(1), 34-39.
- 9: Thur CK, Edgren G, Jansson KL, et al. Epidemiology of adult ankle fractures in Sweden between 1987 and 2004: a population-based study of 91,410 Swedish inpatients. *Acta orthopaedica*, 2012;83(3), 276-281.
- 10: Valtola A, Honkanen R, Kröger H, et al. Lifestyle and other factors predict ankle fractures in perimenopausal women: a population-based prospective cohort study. *Bone*, 2002;30(1), 238-242.
- 11: Seeley DG, Browner WS, Nevitt MC, et al. Which Fractures Are Associated With Low Appendicular Bone Mass in Elderly Women?. *Obstetrical & Gynecological Survey*, 1992;47(6), 424-425.
- 12: Horisberger M, Valderrabano V, Hintermann B. Posttraumatic ankle osteoarthritis after ankle-related fractures. *Journal of orthopaedic trauma*, 2009;23(1), 60-67.
- 13: Lambert N, Kenneth L. The weight-bearing function of the fibula: a strain gauge study. *JBJS*, 1971; 53.3: 507-513.
- 14: Michelson C, James D, et al. Kinematic behavior of the ankle following malleolar fracture repair in a high-fidelity cadaver model. *JBJS*, 2002, 84.11: 2029-2038.
- 15: Siegler S, Chen J, Schneck CD. The three-dimensional kinematics and flexibility characteristics of the human ankle and subtalar joints--Part I: Kinematics. *J Biomech Eng*. 1988 Nov;110(4):364-73. doi: 10.1115/1.3108455.
- 16: Moody ML, Koeneman J, Hettinger E, et al. The effects of fibular and talar displacement on joint contact areas about the ankle. *Orthopaedic review*, 1992;21(6), 741.
- 17: Leardini A, O'connor JJ, Catani F, et al. Kinematics of the human ankle complex in passive flexion; a single degree of freedom system. *Journal of biomechanics*, 1999;32(2), 111-118.
- 18: Gougoulas N, Sakellariou A. When is a simple fracture of the lateral malleolus not so simple? How to assess stability, which ones to fix and the role of the deltoid ligament. *The bone & joint journal*, 2017; 99(7), 851-855.
- 19: Michelson JD, Waldman B. An axially loaded model of the ankle after pronation external rotation injury. *Clinical Orthopaedics and Related Research*, 1996;328, 285-293.
- 20: Tarnita D, Georgescu M, Geonea I, et al. Nonlinear analysis of human ankle dynamics. In *New Trends in Medical and Service Robotics 2019*; (pp. 235-243). Springer, Cham.

- 21: Stiell LG, Greenberg GH, McKnight RD, et al. A study to develop clinical decision rules for the use of radiography in acute ankle injuries. *Annals of emergency medicine*, 1992;21(4), 384-390.
- 22: Brandser EA, Berbaum KS, Dorfman DD, et al. Contribution of individual projections alone and in combination for radiographic detection of ankle fractures. *American Journal of Roentgenology*, 2000;174(6), 1691-1697.
- 23: Ogilvie-Harris DJ, Reed SC. Disruption of the ankle syndesmosis: diagnosis and treatment by arthroscopic surgery. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 1994;10(5), 561-568.
- 24: Black EM, Antoci V, Lee JT, et al. Role of preoperative computed tomography scans in operative planning for malleolar ankle fractures. *Foot & Ankle International*, 2013;34(5), 697-704.
- 25: Harper MC, Keller TS. A radiographic evaluation of the tibiofibular syndesmosis. *Foot & ankle*, 1989;10(3), 156-160.
- 26: Harper MC. An anatomic and radiographic investigation of the tibiofibular clear space. *Foot & ankle*, 1993;14(8), 455-458.
- 27: Shah AS, Kadakia AR, Tan GJ, et al. Radiographic evaluation of the normal distal tibiofibular syndesmosis. *Foot & ankle international*, 2012;33(10), 870-876.
- 28: Nielson JH, Gardner MJ, Peterson MG, et al. Radiographic measurements do not predict syndesmotic injury in ankle fractures: an MRI study. *Clinical Orthopaedics and Related Research*, 2005;436, 216-221.
- 29: Choi Y, Kwon SS, Chung CY, et al. Preoperative radiographic and CT findings predicting syndesmotic injuries in supination-external rotation-type ankle fractures. *JBJS*, 2014;96(14), 1161-1167.
- 30: Ferries JS, DeCoster TA, Firoozbakhsh KK, et al. Plain radiographic interpretation in trimalleolar ankle fractures poorly assesses posterior fragment size. *Journal of orthopaedic trauma*, 1994;8(4), 328-331.
- 31: Büchler L, Tannast M, Bonel HM, et al. Reliability of radiologic assessment of the fracture anatomy at the posterior tibial plafond in malleolar fractures. *Journal of orthopaedic trauma*, 2009;23(3), 208-212.
- 32: Leung KH, Fang CXS, Lau TW, et al. Preoperative radiography versus computed tomography for surgical planning for ankle fractures. *Journal of Orthopaedic Surgery*, 2016;24(2), 158-162.
- 33: Pott P. The classic: some few general remarks on fractures and dislocations. *Clinical Orthopaedics and Related Research*®, 2007;458, 40-41.
- 34: Lauge-Hausen N. Fracture of the ankle III. *Am. J. Roentgenol*, 71, 1954;456-471.
- 35: Thomsen NO, Overgaard S, Olsen LH, et al. Observer variation in the radiographic classification of ankle fractures. *The Journal of bone and joint surgery. British volume*, 1991;73(4), 676-678.
- 36: Yde J. The Lauge Hansen classification of malleolar fractures. *Acta Orthopaedica Scandinavica*, 1980;51(1-6), 181-192.
- 37: Juto H, Nilsson H, Morberg P. Epidemiology of Adult Ankle Fractures: 1756 cases identified in Norrbotten County during 2009–2013 and classified according to AO/OTA. *BMC Musculoskeletal Disorders*, 2018;19(1), 441.
- 38: Fonseca LLD, Nunes IG, Nogueira RR, et al. Reproducibility of the Lauge-Hansen, Danis-Weber, and AO classifications for ankle fractures. *Revista brasileira de ortopedia*, 2018;53(1), 101-106.
- 39: Kearney RS, McKeown R, Gallacher D, et al. Ankle injury rehabilitation (AIR): a feasibility randomised controlled trial comparing functional bracing to plaster cast in the treatment of adult ankle fractures. *Pilot and Feasibility Studies*, 2019;5(1), 1-8.
- 40: Willett K, Keene DJ, Mistry, et al. Close contact casting vs surgery for initial treatment of unstable ankle fractures in older adults: a randomized clinical trial. *Jama*, 2016;316(14),

- 1455-1463.
- 41: SooHoo, N. F., Krenke, L., Eagan, M. J., et al. Complication rates following open reduction and internal fixation of ankle fractures. *JBJS*, 2009;91(5), 1042-1049.
 - 42: Michelson JD, Magid D, McHale K. Clinical utility of a stability-based ankle fracture classification system. *Journal of orthopaedic trauma*, 2007;21(5), 307-315.
 - 43: Haraguchi N, Armiger RSA. New interpretation of the mechanism of ankle fracture. *JBJS*, 2009;91(4), 821-829.
 - 44: Kristensen KD, Hansen T. Closed treatment of ankle fractures: stage II supination-eversion fractures followed for 20 years. *Acta Orthopaedica Scandinavica*, 1985;56(2), 107-109.
 - 45: Port AM, McVie JL, Naylor G, et al. Comparison of two conservative methods of treating an isolated fracture of the lateral malleolus. *The Journal of Bone and Joint Surgery. British volume*, 1996;78(4), 568-572.
 - 46: Stuart PR, Brumby C, Smith SR. Comparative study of functional bracing and plaster cast treatment of stable lateral malleolar fractures. *Injury*, 1989;20(6), 323-326.
 - 47: Wiss DA. (2006). *Fractures*. Lippincott Williams & Wilkins.
 - 48: Müller ME, Perren SM, Allgöwer M, et al. *Manual of internal fixation: techniques recommended by the AO-ASIF group*. Springer Science & Business Media 1991.
 - 49: Herscovici Jr D, Scaduto JM, Infante A. Conservative treatment of isolated fractures of the medial malleolus. *The Journal of bone and joint surgery. British volume*, 2007;89(1), 89-93.
 - 50: Wei SY, Okereke E, Winiarsky R, et al. Nonoperatively treated displaced bimalleolar and trimalleolar fractures: a 20-year follow-up. *Foot & ankle international*, 1999;20(7), 404-407.
 - 51: Strauss EJ, Petrucelli G, Bong, et al. Blisters associated with lower-extremity fracture: results of a prospective treatment protocol. *Journal of orthopaedic trauma*, 2006;20(9), 618-622.
 - 52: Fogel GR, Morrey BF. Delayed open reduction and fixation of ankle fractures. *Clinical Orthopaedics and Related Research*®, 1987;215, 187-195.
 - 53: Makwana NK, Bhowal B, Harper C, et al. Conservative versus operative treatment for displaced ankle fractures in patients over 55 years of age: a prospective, randomised study. *The Journal of Bone and Joint Surgery. British Volume*, 2001;83(4), 525-529.
 - 54: Egol KA, Tejwani NC, Walsh MG, et al. Predictors of short-term functional outcome following ankle fracture surgery. *JBJS*, 2006;88(5), 974-979.
 - 55: Mclaughlin HL, Ryder Jr CT. Open reduction and internal fixation for fractures of the tibia and ankle. *Surgical Clinics of North America*, 1949;29(5), 1523-1534.
 - 56: Carter TH, Oliver WM, Graham C, et al. Medial malleolus: Operative Or Non-operative (MOON) trial protocol-a prospective randomised controlled trial of operative versus non-operative management of associated medial malleolus fractures in unstable fractures of the ankle. *Trials*, 2019;20(1), 1-9.
 - 57: Pankovich AM, Shivaram MS. Anatomical basis of variability in injuries of the medial malleolus and the deltoid ligament: II. Clinical studies. *Acta Orthopaedica Scandinavica*, 1979;50(2), 225-236.
 - 58: Tornetta III P, Creevy W. Lag screw only fixation of the lateral malleolus. *Journal of orthopaedic trauma*, 2001;15(2), 119-121.
 - 59: Zahn RK, Frey S, Jakubietz RG, et al. A contoured locking plate for distal fibular fractures in osteoporotic bone: a biomechanical cadaver study. *Injury*, 2012;43(6), 718-725.
 - 60: Weber M, Krause F. Peroneal tendon lesions caused by antiglide plates used for fixation of lateral malleolar fractures: the effect of plate and screw position. *Foot & ankle international*, 2005;26(4), 281-285.
 - 61: Jain S, Houghton BA, Brew C. Intramedullary fixation of distal fibular fractures: a systematic review of clinical and functional outcomes. *Journal of Orthopaedics and Traumatology*, 2014;15(4), 245-254.

- 62: Siegel J, Tornetta III P. Extraperiosteal plating of pronation-abduction ankle fractures. *JBJS*, 2007;89(2), 276-281.
- 63: Kwaadu KY, Fleming JJ, Lin D. Management of complex fibular fractures: double plating of fibular fractures. *The Journal of Foot and Ankle Surgery*, 2015;54(3), 288-294.
- 64: Koval KJ, Petraco DM, Kummer FJ, et al. A new technique for complex fibula fracture fixation in the elderly: a clinical and biomechanical evaluation. *Journal of orthopaedic trauma*, 1997;11(1), 28-33.
- 65: Kim T, Ayturk UM, Haskell, et al. Fixation of osteoporotic distal fibula fractures: a biomechanical comparison of locking versus conventional plates. *The Journal of foot and ankle surgery*, 2007;46(1), 2-6.
- 66: Parker L, Garlick N, McCarthy I, et al. Screw fixation of medial malleolar fractures: a cadaveric biomechanical study challenging the current AO philosophy. *The bone & joint journal*, 2013;95(12), 1662-1666.
- 67: Minkowitz RB, Bhadsavle S, Walsh M, et al. Removal of painful orthopaedic implants after fracture union. *JBJS*, 2007;89(9), 1906-1912.
- 68: Wegner AM, Wolinsky PR, Robbins MA, et al. Antigliding plating of vertical medial malleolus fractures provides stiffer initial fixation than bicortical or unicortical screw fixation. *Clinical Biomechanics*, 2016;31, 29-32.
- 69: Ebraheim NA, Ludwig T, Weston J, et al. Comparison of surgical techniques of 111 medial malleolar fractures classified by fracture geometry. *Foot & Ankle International*, 2014;35(5), 471-477.
- 70: Hasselman CT, Vogt MT, Stone KL, et al. Foot and ankle fractures in elderly white women: incidence and risk factors. *JBJS*, 2003;85(5), 820-824.
- 71: Mandel J, Behery O, Narayanan R, et al. Single-vs 2-screw lag fixation of the medial malleolus in unstable ankle fractures. *Foot & ankle international*, 2019;40(7), 790-796.
- 72: Parada SA, Gärtner-Tschacher N, Schöttker-Königer T. Bicortical fixation of medial malleolar fractures. *American Journal of Orthopedics*, 2013;42(2), 90-92.
- 73: Pollard JD, Deyhim A, Rigby RB, et al. Comparison of pullout strength between 3.5-mm fully threaded, bicortical screws and 4.0-mm partially threaded, cancellous screws in the fixation of medial malleolar fractures. *The Journal of foot and ankle surgery*, 2010;49(3), 248-252.
- 74: Van den Bekerom MP, Haverkamp D, Kloen P. Biomechanical and clinical evaluation of posterior malleolar fractures: A systematic review of the literature. *Journal of Trauma and Acute Care Surgery*, 2009; 66(1), 279-284.
- 75: Raasch WG, Larkin JJ, Draganich LF. Assessment of the posterior malleolus as a restraint to posterior subluxation of the ankle. *JBJS*, 1992;74(8), 1201-1206.
- 76: Harper MC. Talar shift: the stabilizing role of the medial, lateral, and posterior ankle structures. *Clinical Orthopaedics and Related Research*, 1990;257, 177-183.
- 77: Hartford JM, Gorczyca JT, McNamara JL, et al. Tibiotalar contact area: contribution of posterior malleolus and deltoid ligament. *Clinical Orthopaedics and Related Research*, 1995;320, 182-187.
- 78: Nugent JF, Gale BD. Isolated posterior malleolar ankle fractures. *The Journal of foot surgery*, 1990;29(1), 80.
- 79: Egol KA, Pahl B, Walsh M, et al. Outcome after unstable ankle fracture: effect of syndesmotom stabilization. *Journal of Orthopaedic Trauma*, 2010;24(1), 7-11.
- 80: Gardner MJ, Brodsky A, Briggs A, et al. Fixation of posterior malleolar fractures provides greater syndesmotom stability. *Clinical Orthopaedics and Related Research*, 2006;447, 165-171.
- 81: Haraguchi N, Haruyama H, Toga H, et al. Pathoanatomy of posterior malleolar fractures of the ankle. *JBJS*, 2006;88(5), 1085-1092.
- 82: Abdelgawad AA, Kadous A, Kanlic E. Posterolateral approach for treatment of posterior malleolus fracture of the ankle. *The Journal of foot and ankle surgery*, 2011;50(5), 607-

- 611.
- 83: Bois AJ, Dust W. Posterior fracture dislocation of the ankle: Technique and clinical experience using a posteromedial surgical approach. *J Orthop Trauma*. 2008;22(9):629–636.
 - 84: Forberger J, Sabandal PV, Dietrich M, et al. Posterolateral approach to the displaced posterior malleolus: functional outcome and local morbidity. *Foot & ankle international*, 2009;30(4), 309-314.
 - 85: Schepers T, Van Lieshout EMM, De Vries MR, et al. Increased rates of wound complications with locking plates in distal fibular fractures. *Injury*, 2011;42(10), 1125-1129.
 - 86: Zalavras CG, Christensen T, Rigopoulos N, et al. Infection following operative treatment of ankle fractures. *Clinical Orthopaedics and Related Research*, 2009;467(7), 1715-1720.
 - 87: Goost H, Wimmer MD, Barg A, et al. Fractures of the ankle joint: investigation and treatment options. *Deutsches Ärzteblatt International*, 2014;111(21), 377.
 - 88: Brown OL, Dirschl DR, Obremskey WT. Incidence of hardware-related pain and its effect on functional outcomes after open reduction and internal fixation of ankle fractures. *Journal of orthopaedic trauma*, 2001;15(4), 271-274.
 - 89: Redfern DJ, Sauvé PS, Sakellariou A. Investigation of incidence of superficial peroneal nerve injury following ankle fracture. *Foot & ankle international*, 2003;24(10), 771-774.
 - 90: Utsugi K, Sakai H, Hiraoka H, et al. Intra-articular fibrous tissue formation following ankle fracture: the significance of arthroscopic debridement of fibrous tissue. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 2007;23(1), 89-93.
 - 91: Macera A, Carulli C, Sirleo L, et al. Postoperative complications and reoperation rates following open reduction and internal fixation of ankle fracture. *Joints*, 2018;6(2), 110.
 - 92: Coester LM, Saltzman CL, Leupold J, et al. Long-term results following ankle arthrodesis for post-traumatic arthritis. 2001;JBJS, 83(2), 219.