

## Osteoporose: Therapie-Update 2013, Teil 2 Medikamente heute und morgen

## Ostéoporose: Mises à jour 2013 concernant le traitement, 2<sup>ème</sup> partie Les médicaments d'aujourd'hui et de demain

### Literatur / Références

1. Cauley, J.A., J. Robbins, Z. Chen, S.R. Cummings, R.D. Jackson, A.Z. LaCroix, et al., Effects of estrogen plus progestin on risk of fracture and bone mineral density: the Women's Health Initiative randomized trial. *Jama*, 2003. 290(13): p. 1729–38.
2. Anderson, G.L., M. Limacher, A.R. Assaf, T. Bassford, S.A. Beresford, H. Black, et al., Effects of conjugated equine estrogen in postmenopausal women with hysterectomy: the Women's Health Initiative randomized controlled trial. *Jama*, 2004. 291(14): p. 1701–12.
3. Salpeter, S.R., J.M. Walsh, E. Greyber, and E.E. Salpeter, Brief report: Coronary heart disease events associated with hormone therapy in younger and older women. A meta-analysis. *J Gen Intern Med*, 2006. 21(4): p. 363–6.
4. Birkhäuser, M., P. Hadji, C. De Geyter, G. Finkenstedt, L. Hofbauer, C. Meier, et al., Osteoporose: Phasengerechte Therapie & Neues aus der Zellbiologie. *Journal für Mineralstoffwechsel* 2012. 15: p. 3–7.
5. Seeman, E., G.G. Crans, A. Diez-Perez, K.V. Pinette, and P.D. Delmas, Anti-vertebral fracture efficacy of raloxifene: a meta-analysis. *Osteoporos Int*, 2006. 17(2): p. 313–6.
6. Ettinger, B., D.M. Black, B.H. Mitlak, R.K. Knickerbocker, T. Nickelsen, H.K. Genant, et al., Reduction of vertebral fracture risk in postmenopausal women with osteoporosis treated with raloxifene: results from a 3-year randomized clinical trial. Multiple Outcomes of Raloxifene Evaluation (MORE) Investigators. *Jama*, 1999. 282(7): p. 637–45.
7. Barrett-Connor, E., L. Mosca, P. Collins, M.J. Geiger, D. Grady, M. Kornitzer, et al., Effects of raloxifene on cardiovascular events and breast cancer in postmenopausal women. *N Engl J Med*, 2006. 355(2): p. 125–37.
8. Miller, P.D., A.A. Chines, C. Christiansen, H.C. Hoek, D.L. Kendler, E.M. Lewiecki, et al., Effects of bazedoxifene on BMD and bone turnover in postmenopausal women: 2-yr results of a randomized, double-blind, placebo-, and active-controlled study. *J Bone Miner Res*, 2008. 23(4): p. 525–35.
9. Silverman, S.L., C. Christiansen, H.K. Genant, S. Vukicevic, J.R. Zanchetta, T.J. de Villiers, et al., Efficacy of bazedoxifene in reducing new vertebral fracture risk in postmenopausal women with osteoporosis: results from a 3-year, randomized, placebo-, and active-controlled clinical trial. *J Bone Miner Res*, 2008. 23(12): p. 1923–34.
10. Martino, S., J.A. Cauley, E. Barrett-Connor, T.J. Powles, J. Mershon, D. Disch, et al., Continuing outcomes relevant to Evista: breast cancer incidence in postmenopausal osteoporotic women in a randomized trial of raloxifene. *J Natl Cancer Inst*, 2004. 96(23): p. 1751–61.
11. Birkhäuser, M., Selektive Oestrogen-Rezeptormodulatoren (SERMs) zur Prävention und Therapie der postmenopausalen Osteoporose. *Therap Umschau*, 2012. 69(3): p. 163–72.
12. Russell, R.G., Bisphosphonates: from bench to bedside. *Ann N Y Acad Sci*, 2006. 1068: p. 367–401.
13. Meier, C. and M. Kraenzlin, Diagnostik und Therapie der Osteoporose. 2. Teil. *Swiss Med Forum*, 2006. 116: p. 1161–70.
14. Kraenzlin, M.E. and C. Meier, Schlaglichter 2010: Neue Wege in der Diagnostik und Therapie der Osteoporose. *Swiss Med Forum*, 2011. 11(3): p. 25–28.
15. Bekker, P.J., D.L. Holloway, A.S. Rasmussen, R. Murphy, S.W. Martin, P.T. Leese, et al., A single-dose placebo-controlled study of AMG 162, a fully human monoclonal antibody to RANKL, in postmenopausal women. *J Bone Miner Res*, 2004. 19(7): p. 1059–66.
16. Cummings, S.R., J. San Martin, M.R. McClung, E.S. Siris, R. Eastell, I.R. Reid, et al., Denosumab for prevention of fractures in postmenopausal women with osteoporosis. *N Engl J Med*, 2009. 361(8): p. 756–65.
17. Kendler, D.L., C. Roux, C.L. Benhamou, J.P. Brown, M. Lillstol, S. Siddhanti, et al., Effects of denosumab on bone mineral density and bone turnover in postmenopausal women transitioning from alendronate therapy. *J Bone Miner Res*, 2010. 25(1): p. 72–81.
18. Pierroz, D.D., N. Bonnet, P.A. Baldock, M.S. Ominsky, M. Stolina, P.J. Kostenuik, et al., Are osteoclasts needed for the bone anabolic response to parathyroid hormone? A study of intermittent parathyroid hormone with denosumab or alendronate in knock-in mice expressing humanized RANKL. *J Biol Chem*, 2010. 285(36): p. 28164–73.
19. Kostenuik, P.J., S.Y. Smith, J. Jolette, J. Schroeder, I. Pyrah, and M.S. Ominsky, Decreased bone remodeling and porosity are associated with improved bone strength in ovariectomized cynomolgus monkeys treated with denosumab, a fully human RANKL antibody. *Bone*, 2011. 49(2): p. 151–61.

20. Seeman, E., P.D. Delmas, D.A. Hanley, D. Sellmeyer, A.M. Cheung, E. Shane, et al., Microarchitectural deterioration of cortical and trabecular bone: differing effects of denosumab and alendronate. *J Bone Miner Res*, 2010. 25(8): p. 1886–94.
21. Brown, J.P., R.L. Prince, C. Deal, R.R. Recker, D.P. Kiel, L.H. de Gregorio, et al., Comparison of the effect of denosumab and alendronate on BMD and biochemical markers of bone turnover in postmenopausal women with low bone mass: a randomized, blinded, phase 3 trial. *J Bone Miner Res*, 2009. 24(1): p. 153–61.
22. McClung, M.R., J.R. Zanchetta, A. Hoiseth, D.L. Kendler, C.K. Yuen, J.P. Brown, et al., Denosumab densitometric changes assessed by quantitative computed tomography at the spine and hip in postmenopausal women with osteoporosis. *J Clin Densitom*, 2013. 16(2): p. 250–6.
23. Zebaze, R.M., A. Ghasem-Zadeh, A. Bohte, S. Iuliano-Burns, M. Mirams, R.I. Price, et al., Intracortical remodelling and porosity in the distal radius and post-mortem femurs of women: a cross-sectional study. *Lancet*, 2010. 375(9727): p. 1729–36.
24. Baron, R., S. Ferrari, and R.G. Russell, Denosumab and bisphosphonates: different mechanisms of action and effects. *Bone*, 2011. 48(4): p. 677–92.
25. Block, G.A., H.G. Bone, L. Fang, E. Lee, and D. Padhi, A single-dose study of denosumab in patients with various degrees of renal impairment. *J Bone Miner Res*, 2012. 27(7): p. 1471–9.
26. McClung, M.R., E.M. Lewiecki, S.B. Cohen, M.A. Bolognese, G.C. Woodson, A.H. Moffett, et al., Denosumab in postmenopausal women with low bone mineral density. *N Engl J Med*, 2006. 354(8): p. 821–31.
27. Miller, P.D., M.A. Bolognese, E.M. Lewiecki, M.R. McClung, B. Ding, M. Austin, et al., Effect of denosumab on bone density and turnover in postmenopausal women with low bone mass after long-term continued, discontinued, and re-starting of therapy: a randomized blinded phase 2 clinical trial. *Bone*, 2008. 43(2): p. 222–9.
28. Bone, H.G., M.A. Bolognese, C.K. Yuen, D.L. Kendler, P.D. Miller, Y.C. Yang, et al., Effects of denosumab treatment and discontinuation on bone mineral density and bone turnover markers in postmenopausal women with low bone mass. *J Clin Endocrinol Metab*, 2011. 96(4): p. 972–80.
29. Brown, J.P., C. Roux, O. Torring, P.R. Ho, J.E. Beck Jensen, N. Gilchrist, et al., Discontinuation of denosumab and associated fracture incidence: analysis from the Fracture Reduction Evaluation of Denosumab in Osteoporosis Every 6 Months (FREEDOM) trial. *J Bone Miner Res*, 2013. 28(4): p. 746–52.
30. McClung, M.R., E.M. Lewiecki, M.L. Geller, M.A. Bolognese, M. Peacock, R.L. Weinstein, et al., Effect of denosumab on bone mineral density and biochemical markers of bone turnover: 8-year results of a phase 2 clinical trial. *Osteoporos Int*, 2013. 24(1): p. 227–35.
31. Papapoulos, S., R. Chapurlat, C. Libanati, M.L. Brandi, J.P. Brown, E. Czerwinski, et al., Five years of denosumab exposure in women with postmenopausal osteoporosis: results from the first two years of the FREEDOM extension. *J Bone Miner Res*, 2012. 27(3): p. 694–701.
32. Watts, N.B., C. Roux, J.F. Modlin, J.P. Brown, A. Daniels, S. Jackson, et al., Infections in postmenopausal women with osteoporosis treated with denosumab or placebo: coincidence or causal association? *Osteoporos Int*, 2012. 23(1): p. 327–37.
33. Gelb, B.D., G.P. Shi, H.A. Chapman, and R.J. Desnick, Pycnodysostosis, a lysosomal disease caused by cathepsin K deficiency. *Science*, 1996. 273(5279): p. 1236–8.
34. Saftig, P., E. Hunziker, O. Wehmeyer, S. Jones, A. Boyde, W. Rommerskirch, et al., Impaired osteoclastic bone resorption leads to osteopetrosis in cathepsin-K-deficient mice. *Proc Natl Acad Sci U S A*, 1998. 95(23): p. 13453–8.
35. Gowen, M., F. Lazner, R. Dodds, R. Kapadia, J. Feild, M. Tavaría, et al., Cathepsin K knockout mice develop osteopetrosis due to a deficit in matrix degradation but not demineralization. *J Bone Miner Res*, 1999. 14(10): p. 1654–63.
36. Meier, C. and M. Kraenzlin, Cathepsin-K-Inhibitoren in der Osteoporosetherapie. *Osteologie*, 2011. 20(3): p. 211–16.
37. Costa, A.G., N.E. Cusano, B.C. Silva, S. Cremers, and J.P. Bilezikian, Cathepsin K: its skeletal actions and role as a therapeutic target in osteoporosis. *Nat Rev Rheumatol*, 2011.
38. Rachner, T.D., S. Khosla, and L.C. Hofbauer, Osteoporosis: now and the future. *Lancet*, 2011. 377(9773): p. 1276–87.
39. Bone, H.G., M.R. McClung, C. Roux, R.R. Recker, J.A. Eisman, N. Verbruggen, et al., Odanacatib, a cathepsin-K inhibitor for osteoporosis: a two-year study in postmenopausal women with low bone density. *J Bone Miner Res*, 2010. 25(5): p. 937–47.
40. Eisman, J.A., H.G. Bone, D.J. Hosking, M.R. McClung, I.R. Reid, R. Rizzoli, et al., Odanacatib in the treatment of postmenopausal women with low bone mineral density: three-year continued therapy and resolution of effect. *J Bone Miner Res*, 2011. 26(2): p. 242–51.
41. Greenspan, S.L., R.D. Emkey, H.G. Bone, S.R. Weiss, N.H. Bell, R.W. Downs, et al., Significant differential effects of alendronate, estrogen, or combination therapy on the rate of bone loss after discontinuation of treatment of postmenopausal osteoporosis. A randomized, double-blind, placebo-controlled trial. *Ann Intern Med*, 2002. 137(11): p. 875–83.
42. Baron, R. and M. Kneissel, WNT signaling in bone homeostasis and disease: from human mutations to treatments. *Nat Med*, 2013. 19(2): p. 179–92.
43. Milat, F. and K.W. Ng, Is Wnt signalling the final common pathway leading to bone formation? *Mol Cell Endocrinol*, 2009. 310(1–2): p. 52–62.
44. Kraenzlin, M.E. and C. Meier, Parathyroid hormone analogues in the treatment of osteoporosis. *Nat Rev Endocrinol*, 2011. 7(11): p. 647–56.
45. McClung, M.R., J. San Martin, P.D. Miller, R. Civitelli, F. Bandeira, M. Omizo, et al., Opposite bone remodeling effects of teriparatide and alendronate in increasing bone mass. *Arch Intern Med*, 2005. 165(15): p. 1762–8.
46. Hodsman, A.B., D.C. Bauer, D.W. Dempster, L. Dian, D.A. Hanley, S.T. Harris, et al., Parathyroid hormone and teriparatide for the treatment of osteoporosis: a review of the evidence and suggested guidelines for its use. *Endocr Rev*, 2005. 26(5): p. 688–703.
47. Baron, R., H. Saito, and F. Gori, Bone cells crosstalk: noncanonical Roring in the Wnt. *Cell Metab*, 2012. 15(4): p. 415–7.
48. Papapoulos, S.E., Targeting sclerostin as potential treatment of osteoporosis. *Ann Rheum Dis*, 2011. 70 Suppl 1: p. i119–22.
49. Padhi, D., G. Jang, B. Stouch, L. Fang, and E. Posvar, Single-dose, placebo-controlled, randomized study of AMG 785, a sclerostin monoclonal antibody. *J Bone Miner Res*, 2011. 26(1): p. 19–26.
50. Brewer, L., D. Williams, and A. Moore, Current and future treatment options in osteoporosis. *Eur J Clin Pharmacol*, 2011. 67(4): p. 321–31.