

## **BÖLÜM 28**

### **GONADOTROPİN SALGILAYAN HORMON ANTAGONİSTLERİ**

Aykut DEMİRKIRAN<sup>1</sup>

#### **GİRİŞ**

Androjenlerin prostat kanseri gelişimindeki rolü 1941 yılında Huggins ve Hodges tarafından belirlenmiştir (1,2). Prostat kanseri hücreleri genellikle büyümek için testosteron gibi androjen hormonlarına ihtiyaç duyar. Bu bulgu androjen deprivasyon tedavisinin (ADT) gelişmesine yol açtı. Günümüzde ADT, metastatik prostat kanseri tedavisinin köşe taşıdır ve orta veya yüksek riskli lokalize hastalıkta da kullanılmaktadır (3). ADT, bilateral orşiektomi ile cerrahi olarak veya luteinizing hormone-releasing hormone (LHRH) agonistleri veya gonadotropin-releasing hormone (GnRH) antagonistleri kullanılarak medikal olarak elde edilebilir (4). FDA, üçüncü kuşak bir GnRH antagonisti olan degarelix'i 2008'de ve oral yoldan uygulanan ilk GnRH antagonisti olan relugolix'i 2020'de ileri evre prostat kanserinde onayladı (5,6).

#### **ANDROJEN DEPRİVASYON TEDAVİSİ**

ADT ile serum testosteronunu kastrasyon seviyelerine ( $<50 \text{ ng/dL}$ ;  $<1.7 \text{ nmol/L}$ ) düşürmek ve böylece androjen reseptörünün aktivasyonunu önlemek hedeflenmektedir. Androjenler androjen reseptörüne bağlandığında, hücre farklılaşmasını ve olgunlaşmasını kontrol eden gen transkripsiyonunu destekler (7). Son kanıtlar orşiektominin bir LHRH agonistinden daha güvenli olabileceğini düşündürse de de, cerrahi kastrasyonun geri döndürülemez olması ve hasta üzerindeki önemli psikososyal etkileri nedeniyle medikal kastrasyon daha sık kullanılmaktadır (8).

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## SONUÇ

ADT, metastatik prostat kanserinde temel tedavi yöntemidir. ADT, cerrahi veya medikal kastrasyon olarak uygulanabilir. LHRH agonistleri, medikal kastrayon için yaygın olarak kullanılır, ancak ilişkili alevlenme fenomeni ve yetersiz testosteron kontrolü oluşabilir. GnRH antagonistleri, alevlenme fenomeni görülmeden testosteronu kastrasyon seviyelerine daha hızlı baskılardır, bu nedenle antiandrojenlerin birlikte uygulanması gereksizdir. Degarelix, abarelix'in histamin aracılı reaksiyonlar nedeniyle kullanımından kaldırılmışından bu yana en yaygın kullanılan GnRH antagonistidir. Relugolix, leuprolide'inden daha iyi kastrasyon seviyelerine ulaşabilen ve bunu sürdürürebilen FDA onaylı ilk oral GnRH antagonistidir, ancak klinik deneyim şu anda sınırlıdır. GnRH antagonistleri kullanımın yararı, kardiyovasküler komorbiditesi olan hastalarda daha belirgindir. GnRH antagonistleri ile tedavi için uygun hastalar, semptomatik veya eşlik eden kardiyovasküler komorbiditeleri olan ileri evre prostat kanseri hastalarıdır.

## KAYNAKLAR

1. Huggins C, Hodges CV. Studies on prostatic cancer. I. The effect of castration, of estrogen and androgen injection on serum phosphatases in metastatic carcinoma of the prostate. *CA Cancer J Clin.* 1972;22(4):232-240. doi:10.3322/cancclin.22.4.232
2. Huggins C, Stevens RE, Hodges CV. Studies on prostatic cancer: II. The effects of castration on advanced carcinoma of the prostate gland. *Arch Surg* 1941;43(2):209–223.
3. Bolla M, Van Tienhoven G, Warde P, et al. External irradiation with or without long-term androgen suppression for prostate cancer with high metastatic risk: 10-year results of an EORTC randomised study. *Lancet Oncol.* 2010;11(11):1066-1073. doi:10.1016/S1470-2045(10)70223-0
4. Perlmutter MA, Lepor H. Androgen deprivation therapy in the treatment of advanced prostate cancer. *Rev Urol.* 2007;9 Suppl 1(Suppl 1):S3-S8.
5. Dellis A, Papatsoris A. Therapeutic outcomes of the LHRH antagonists. *Expert Rev Pharmacoecon Outcomes Res.* 2017;17(5):481-488. doi:10.1080/14737167.2017.1375855
6. Shore ND, Saad F, Cookson MS, et al. Oral Relugolix for Androgen-Deprivation Therapy in Advanced Prostate Cancer. *N Engl J Med.* 2020;382(23):2187-2196. doi:10.1056/NEJMoa2004325
7. Ryan CJ, Tindall DJ. Androgen receptor rediscovered: the new biology and targeting the androgen receptor therapeutically. *J Clin Oncol.* 2011;29(27):3651-3658. doi:10.1200/JCO.2011.35.2005
8. Kolinsky M, de Bono JS. The Ongoing Challenges of Targeting the Androgen Receptor. *Eur Urol.* 2016;69(5):841-843. doi:10.1016/j.eururo.2015.10.052
9. McLeod D, Zinner N, Tomera K, et al. A phase 3, multicenter, open-label, randomized study of abarelix versus leuprolide acetate in men with prostate cancer. *Urology.* 2001;58(5):756-761. doi:10.1016/s0090-4295(01)01342-5
10. Frampton JE, Lyseng-Williamson KA. Degarelix. *Drugs.* 2009;69(14):1967-1976. doi:10.2165/10484080-00000000-00000
11. Broqua P, Riviere PJ, Conn PM, Rivier JE, Aubert ML, Junien JL. Pharmacological profile of a new, potent, and long-acting gonadotropin-releasing hormone antagonist: degarelix. *J Pharmacol Exp Ther.* 2002;301(1):95-102. doi:10.1124/jpet.301.1.95
12. Boccon-Gibod L, van der Meulen E, Persson BE. An update on the use of gonadotropin-releasing hormone antagonists in prostate cancer. *Ther Adv Urol.* 2011;3(3):127-140. doi:10.1177/1756287211414457

13. Klotz L, Boccon-Gibod L, Shore ND, et al. The efficacy and safety of degarelix: a 12-month, comparative, randomized, open-label, parallel-group phase III study in patients with prostate cancer. *BJU Int.* 2008;102(11):1531-1538. doi:10.1111/j.1464-410X.2008.08183.x
14. Klotz L. Pharmacokinetic and pharmacodynamic profile of degarelix for prostate cancer. *Expert Opin Drug Metab Toxicol.* 2015;11(11):1795-1802. doi:10.1517/17425255.2015.1085506
15. Sonesson A, Rasmussen BB. In vitro and in vivo human metabolism of degarelix, a gonadotropin-releasing hormone receptor blocker. *Drug Metab Dispos.* 2013;41(7):1339-1346. doi:10.1124/dmd.113.051706
16. Tombal B, Miller K, Boccon-Gibod L, et al. Additional analysis of the secondary end point of biochemical recurrence rate in a phase 3 trial (CS21) comparing degarelix 80 mg versus leuprolide in prostate cancer patients segmented by baseline characteristics. *Eur Urol.* 2010;57(5):836-842. doi:10.1016/j.eururo.2009.11.029
17. Crawford ED, Shore ND, Moul JW, et al. Long-term tolerability and efficacy of degarelix: 5-year results from a phase III extension trial with a 1-arm crossover from leuprolide to degarelix. *Urology.* 2014;83(5):1122-1128. doi:10.1016/j.urology.2014.01.013
18. Klotz L, Miller K, Crawford ED, et al. Disease control outcomes from analysis of pooled individual patient data from five comparative randomised clinical trials of degarelix versus luteinising hormone-releasing hormone agonists. *Eur Urol.* 2014;66(6):1101-1108. doi:10.1016/j.eururo.2013.12.063
19. Sciarra A, Fasulo A, Ciardi A, et al. A meta-analysis and systematic review of randomized controlled trials with degarelix versus gonadotropin-releasing hormone agonists for advanced prostate cancer [published correction appears in Medicine (Baltimore). 2016 Dec 09;95(49):e5671]. *Medicine (Baltimore).* 2016;95(27):e3845. doi:10.1097/MD.0000000000003845
20. Abufaraj M, Iwata T, Kimura S, et al. Differential Impact of Gonadotropin-releasing Hormone Antagonist Versus Agonist on Clinical Safety and Oncologic Outcomes on Patients with Metastatic Prostate Cancer: A Meta-analysis of Randomized Controlled Trials. *Eur Urol.* 2021;79(1):44-53. doi:10.1016/j.eururo.2020.06.002
21. Schröder FH, Tombal B, Miller K, et al. Changes in alkaline phosphatase levels in patients with prostate cancer receiving degarelix or leuprolide: results from a 12-month, comparative, phase III study. *BJU Int.* 2010;106(2):182-187. doi:10.1111/j.1464-410X.2009.08981.x
22. Anderson J, Al-Ali G, Wirth M, et al. Degarelix versus goserelin (+ antiandrogen flare protection) in the relief of lower urinary tract symptoms secondary to prostate cancer: results from a phase IIIb study (NCT00831233). *Urol Int.* 2013;90(3):321-328. doi:10.1159/000345423
23. Mason M, Richaud P, Bosnyak Z, Malmberg A, Neijber A. Degarelix Versus Goserelin Plus Bicalutamide in the Short-Term Relief of Lower Urinary Tract Symptoms in Prostate Cancer Patients: Results of a Pooled Analysis. *Low Urin Tract Symptoms.* 2017;9(2):82-88. doi:10.1111/luts.12114
24. Mason M, Maldonado Pijoan X, Steidle C, et al. Neoadjuvant androgen deprivation therapy for prostate volume reduction, lower urinary tract symptom relief and quality of life improvement in men with intermediate- to high-risk prostate cancer: a randomised non-inferiority trial of degarelix versus goserelin plus bicalutamide. *Clin Oncol (R Coll Radiol).* 2013;25(3):190-196. doi:10.1016/j.clon.2012.09.010
25. MacLean DB, Shi H, Faessel HM, Saad F. Medical Castration Using the Investigational Oral GnRH Antagonist TAK-385 (Relugolix): Phase 1 Study in Healthy Males. *J Clin Endocrinol Metab.* 2015;100(12):4579-4587. doi:10.1210/jc.2015-2770
26. Dearnaley DP, Saltzstein DR, Sylvester JE, et al. The Oral Gonadotropin-releasing Hormone Receptor Antagonist Relugolix as Neoadjuvant/Adjuvant Androgen Deprivation Therapy to External Beam Radiotherapy in Patients with Localised Intermediate-risk Prostate Cancer: A Randomised, Open-label, Parallel-group Phase 2 Trial. *Eur Urol.* 2020;78(2):184-192. doi:10.1016/j.eururo.2020.03.001
27. Saad F, Bailen JL, Pieczonka CM, et al. Second interim analysis (IA2) results from a phase II trial of TAK-385, an oral GnRH antagonist, in prostate cancer patients (pts). *J Clin Oncol.* 2016;34:200

28. Hupe MC, Hammerer P, Ketz M, Kossack N, Colling C, Merseburger AS. Retrospective Analysis of Patients With Prostate Cancer Initiating GnRH Agonists/Antagonists Therapy Using a German Claims Database: Epidemiological and Patient Outcomes. *Front Oncol.* 2018;8:543. Published 2018 Nov 27. doi:10.3389/fonc.2018.00543
29. Albertsen PC, Klotz L, Tombal B, Grady J, Olesen TK, Nilsson J. Cardiovascular morbidity associated with gonadotropin releasing hormone agonists and an antagonist. *Eur Urol.* 2014;65(3):565-573. doi:10.1016/j.eururo.2013.10.032
30. Olsson H, Petri N, Erichsen L, Malmberg A, Grundemar L. Effect of Degarelix, a Gonadotropin-Releasing Hormone Receptor Antagonist for the Treatment of Prostate Cancer, on Cardiac Repolarisation in a Randomised, Placebo and Active Comparator Controlled Thorough QT/QTc Trial in Healthy Men. *Clin Drug Investig.* 2017;37(9):873-879. doi:10.1007/s40261-017-0547-7.
31. Lopes RD, Higano CS, Slovin SF, et al. Cardiovascular Safety of Degarelix Versus Leuprorelin in Patients With Prostate Cancer: The Primary Results of the PRONOUNCE Randomized Trial [published correction appears in Circulation. 2021 Oct 19;144(16):e273]. *Circulation.* 2021;144(16):1295-1307. doi:10.1161/CIRCULATIONAHA.121.056810
32. Zengerling F, Jakob JJ, Schmidt S, et al. Degarelix for treating advanced hormone-sensitive prostate cancer. *Cochrane Database Syst Rev.* 2021;8(8):CD012548. Published 2021 Aug 5. doi:10.1002/14651858.CD012548.pub2
33. Sawazaki H, Araki D, Kitamura Y, Yagi K. Metabolic changes with degarelix vs leuprorelin plus bicalutamide in patients with prostate cancer: a randomized clinical study. *World J Urol.* 2020;38(6):1465-1471. doi:10.1007/s00345-019-02937-x
34. Tokiwa S, Shimmura H, Nomura S, et al. Degarelix treatment is compatible with diabetes and antithrombotic therapy in patients with prostate cancer. *Res Rep Urol.* 2017;9:225-232. Published 2017 Dec 6. doi:10.2147/RRU.S146180
35. Mohamad NV, Ima-Nirwana S, Chin KY. The Skeletal Effects of Gonadotropin-Releasing Hormone Antagonists: A Concise Review. *Endocr Metab Immune Disord Drug Targets.* 2021;21(10):1713-1720.
36. Jayusman PA, Mohamed IN, Shuid AN. The Effects of Chemical Castration with Degarelix on Bone Turnover: Densitometric and Biomechanics Bone Properties of Male Rats. *Int J Endocrinol Metab.* 2018;16(3):e64038. Published 2018 Jul 2. doi:10.5812/ijem.64038