

BÖLÜM 18

KİSSİNG BALON

Ömer TAŞBULAK

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1.Giriş

Bifurkasyon lezyonları sık karşılaşılan karmaşık ve zorlu koroner lezyonlardır. Kissing balon (KB) dilatasyonu bifurkasyon lezyonları için geliştirilen ilk yöntemlerdendir ve bu lezyonlarda hala önemli bir role sahiptir. KB stent apozisyonunu optimize etmek, stent deformasyonunu ve distorsiyonunu düzeltirken yan dala erişimi iyileştirmek için önerilmiştir. Yıllar boyunca KB tekniği bench testleri ve bilgisayar simülasyonlarından, in vivo intravasküler görüntüleme ve klinik çalışmalara kadar derinlemesine araştırılmıştır, böylece bu tekniğin kısıtlamaları ve yararları konusunda geniş bir data oluşmuştur.

Kissing balon terimi ilk olarak Gruentzig tarafından iliak bifurkasyon stenozunun perkütan tedavisinin tanımlamasında kullanılmıştır. Bu tekniğin ilk kullanımı ise 1980 yılında Velasquez ve arkadaşla-

rı tarafından Leriche sendromlu bir hastanın distal aorta anjioplastisi işleminde olmuştur (1). 1984 yılında ise ilk olarak perkütan koroner girişimde kissing balon dilatasyonu uygulanmıştır (2). Tekniğin ilk uygulanmaya başlandığı yıllarda iki farklı vasküler giriş yolundan yerleştirilen iki kılavuz kateter üzerinden yerleştirilen balonlar ile dilatasyon uygulanıyordu. Ayrıca damar diseksiyonu riskinin daha az olacağı düşünüldüğü için simultane kissing yerine sıralı balon dilatasyonu uygulanmaktaydı. 1986 yılında Oesterle ve arkadaşları tarafından iki farklı kılavuz kateter yerine tek bir kılavuz kateter ve iki kılavuz tel üzerinden uygulanmaya başlanan kissing balon dilatasyonuna o dönemde "kissing wire tekniği" de denilmekteydi (3). İlk uygulandığı dönemlerde iki on-the-wire sistem balon ile kissing dilatasyonu şeklinde yapılan prosedür (4) 1989 yılında Myler ve arkadaşları tarafından bir fiks kılavuz tel ve bir over the wire balon ile (5),

Snuggle kissing balon dilatasyon: Ya dal balonunun ana dala bir kaç mm protrüzyonu ile birlikte kissing balon dilatasyon. Özellikle Rigatelli ve arkadaşları tarafından tariflenen nano inverted T stentleme (nano crush) işleminde veya ana dal proksimalinde POT yapacak yeterli mesafe veya uygun uzunlukta POT balonu bulunmadığı durumlarda uygulanabilir (**Video 18.2**).



Video 18.2. Snugle kissing balon dilatasyon. Ya dal balonunun ana dala bir kaç mm protrüzyonu ile birlikte kissing balon dilatasyon. Özellikle Rigatelli ve arkadaşları tarafından tariflenen nano inverted T stentleme (nano crush) işleminde veya ana dal proksimalinde POT yapacak yeterli mesafe veya uygun uzunlukta POT balonu bulunmadığı durumlarda uygulanabilir.
(POT: proksimal optimizasyon)

Simultane kissing balon: Özellikle Nano DK nano culotte stentleme de tarif edilse de culotte stentleme tekniklerinde yan dal stenti deformasyonunu engellemek için yan dal stent implantasyonu sonrasında önce yan dal ardından ana dal balonu açılarak simultane kissing balon dilatasyonu. Ana dal stent implantasyonu sonrasında ise önce ana dal ardından yan dal balonu açılarak simultane kissing balon dilatasyonu. Balonların eş zamanlı indirilmesi önerilmektedir (**Video 18.3**).



Video 18.3. Özellikle DK nano culotte stentleme de tarif edilse de culotte stentleme tekniklerinde yan dal stenti deformasyonunu engellemek için yan dal stent implantasyonu sonrasında önce yan dal ardından ana dal balonu açılarak simultane kissing balon dilatasyonu. Ana dal stent implantasyonu sonrasında ise önce ana dal ardından yan dal balonu açılarak simultane kissing balon dilatasyonu. Balonların eş zamanlı indirilmesi önerilmektedir.

Kaynaklar

1. Velasquez G, Castaneda-Zuniga W, Formanek A, et al. Nonsurgical aortoplasty in Leriche syndrome. *Radiology* 1980;134:359–60.
2. Meier B. Kissing balloon coronary angioplasty. *Am J Cardiol* 1984;54: 918–20.
3. Oesterle SN, McAuley BJ, Buchbinder M, Simpson JB. Angioplasty at coronary bifurcations: single-guide, two-wire technique. *Cathet Cardiovasc Diagn* 1986;12:57– 63.
4. van Leeuwen K, Blans W, Pijls NH, van der Werf T. Kissing balloon angioplasty of a circumflex artery bifurcation lesion. A new approach utilizing two balloon-on-wire probes and a single guiding catheter. *Chest* 1989;95:1144 –5.
5. Myler RK, McConahay DR, Stertz SH, et al. Coronary bifurcation stenoses: the kissing balloon probe technique via a single guiding catheter. *Cathet Cardiovasc Diagn* 1989;16:267–78.
6. den Heijer P, Bernink PJ, van Dijk RB, Twisk SP, Lie KI. The kissing balloon technique with two over-the-wire balloon catheters through a single 8-French guiding catheter. *Cathet Cardiovasc Diagn* 1991;23:47–9.

7. Castriz JL, Canales ML, Reynolds DW. Kissing balloon technique in complex PTCA: single guiding catheter and dual wire rapid exchange system. *Cathet Cardiovasc Diagn* 1993;28:358–60.
8. Krikorian RK, Vacek JL, Beauchamp GB. "Kissing balloon" technique in percutaneous transluminal coronary angiography: single-guide catheter, dual-wire, dual-balloon system with single inflation device. *Cathet Cardiovasc Diagn* 1996;37:331–3.
9. Prasad N, Seidelin PH. Sidebranch compromise during percutaneous coronary interventions. *J Invasive Cardiol* 2002;14:138–45.
10. Ioannidis JP, Karvouni E, Katritsis DG. Mortality risk conferred by small elevations of creatine kinase-MB isoenzyme after percutaneous coronary intervention. *J Am Coll Cardiol* 2003;42:1406–11.
11. Nienhuis MB, Ottervanger JP, Bilo HJ, Dikkeschei BD, Zijlstra F. Prognostic value of troponin after elective percutaneous coronary intervention: A meta-analysis. *Catheter Cardiovasc Interv* 2008;71: 318–24.
12. Popma JJ, Mauri L, O'Shaughnessy C, et al. Frequency and clinical consequences associated with sidebranch occlusion during stent implantation using zotarolimus-eluting and paclitaxel-eluting coronary stents. *Circ Cardiovasc Interv* 2009;2:133–9.
13. Poerner TC, Kravlev S, Voelker W, et al. Natural history of small and medium-sized side branches after coronary stent implantation. *Am Heart J* 2002;143:627–35.
14. Ormiston JA, Webster MW, Ruygrok PN, Stewart JT, White HD, Scott DS. Stent deformation following simulated side-branch dilatation: a comparison of five stent designs. *Catheter Cardiovasc Interv* 1999;47:258–64.
15. Ormiston JA, Webster MW, El Jack S, et al. Drug-eluting stents for coronary bifurcations: bench testing of provisional side-branch strategies. *Catheter Cardiovasc Interv* 2006;67:49–55.
16. Ormiston JA, Currie E, Webster MW, et al. Drug-eluting stents for coronary bifurcations: insights into the crush technique. *Catheter Cardiovasc Interv* 2004;63:332–6.
17. Ormiston JA, Webster MW, Webber B, Stewart JT, Ruygrok PN, Hatrick RI. The "crush" technique for coronary artery bifurcation stenting: insights from micro-computed tomographic imaging of bench deployments. *J Am Coll Cardiol Intv* 2008;1:351–7.
18. Murasato Y. Impact of three-dimensional characteristics of the left main coronary artery bifurcation on outcome of crush stenting. *Catheter Cardiovasc Interv* 2007;69:248–56.
19. Murasato Y, Hikichi Y, Horiuchi M. Examination of stent deformation and gap formation after complex stenting of left main coronary artery bifurcations using microfocus computed tomography. *J Interv Cardiol* 2009;22:135–44.
20. Hikichi Y, Inoue T, Node K. Benefits and limitations of cypher stent-based bifurcation approaches: in vitro evaluation using microfocus CT scan. *J Interv Cardiol* 2009;22:128–34.
21. Guérin P, Pilet P, Finet G, et al. Drug-eluting stents in bifurcations: bench study of strut deformation and coating lesions. *Circ Cardiovasc Interv* 2010;3:120–6.
22. Foin N, Secco GG, Ghilencea L, Krams R, Di Mario C. Final proximal post-dilatation is necessary after kissing balloon in bifurcation stenting. *EuroIntervention* 2011;7:597–604.
23. Nakazawa G, Yazdani SK, Finn AV, Vorpahl M, Kolodgie FD, Virmani R. Pathological findings at bifurcation lesions: the impact of flow distribution on atherosclerosis and arterial healing after stent implantation. *J Am Coll Cardiol* 2010;55:1679–87.
24. de Lezo JS, Medina A, Martí'n P, et al. Ultrasound findings during percutaneous treatment of bifurcated coronary lesions. *Rev Esp Cardiol* 2008;61:930–5.
25. Pan M, Medina A, Suárez de Lezo J, et al. Coronary bifurcation lesions treated with simple approach (from the Cordoba & Las Palmas [CORPAL] Kiss trial). *Am J Cardiol* 2011;107:1460–5.
26. Foin N, Viceconte N, Chan PH, Lindsay AC, Krams R, Di Mario C. Jailed side branches: fate of unapposed struts studied with 3D frequency-domain optical coherence tomography. *J Cardiovasc Med (Hagerstown)* 2011;12:581–2.
27. Di Mario C, Iakovou I, van der Giessen WJ, et al. Optical coherence tomography for guidance in bifurcation lesion treatment. *EuroIntervention* 2010;6 Suppl J:J99–J106.
28. Her AY, Lee BK, Shim JM, et al. Neointimal coverage on drug-eluting stent struts crossing side-branch vessels using optical coherence tomography. *Am J Cardiol* 2010;105:1565–9.
29. Costa RA, Mintz GS, Carlier SG, et al. Bifurcation coronary lesions treated with the "crush" technique: an intravascular ultrasound analysis. *J Am Coll Cardiol* 2005;46:599–605.
30. Chen SL, Mintz G, Kan J, et al. Serial intravascular ultrasound analysis comparing double kissing (DK) and classical crush stenting for coronary bifurcation lesions. *Catheter Cardiovasc Interv* 2011;78:729–36.
31. Zhang JJ, Chen SL, Ye F, et al. Mechanisms and clinical significance of quality of final kissing balloon inflation in patients with true bifurcation lesions treated by crush stenting technique. *Chin Med J (Engl)* 2009;122:2086–91.
32. Koo BK, Park KW, Kang HJ, et al. Physiological evaluation of the provisional side-branch intervention strategy for bifurcation lesions using fractional flow reserve. *Eur Heart J* 2008;29:726–32.
33. Burzotta F, Trani C, Todaro D, et al. Prospective evaluation of myocardial ischemia related to post-procedural side-branch stenosis in bifurcated lesions treated by provisional approach with drug-eluting stents. *Catheter Cardiovasc Interv* 2012;79:351–9.
34. Kumsars I, Narbutė I, Thuesen L, et al. Side branch fractional flow reserve measurements after main vessel stenting: a Nordic-Baltic Bifurcation Study III substudy. *EuroIntervention* 2012;7:1155–61.

35. Sgueglia GA, Todaro D, Bisciglia A, Conte M, Stipo A, Pucci E. Kissing inflation is feasible with all second-generation drug-eluting balloons. *Cardiovasc Revasc Med* 2011;12:280–5
36. Sgueglia GA, Todaro D, Stipo A, Pucci E. Simultaneous inflation of two drug-eluting balloons for the treatment of coronary bifurcation restenosis: a concept series. *J Invasive Cardiol* 2011;23:474–6.
37. Sgueglia GA, Todaro D, Pucci E. Drug-eluting balloon offers a new opportunity in percutaneous bifurcation interventions. *EuroIntervention* 2011;7:764–6.
38. Stankovic G, Darremont O, Ferenc M, et al. Percutaneous coronary intervention for bifurcation lesions: 2008 consensus document from the fourth meeting of the European Bifurcation Club. *EuroIntervention* 2009;5:39–49.
39. Rab T, Sheiban I, Louvard Y, Sawaya FJ, Zhang JJ, Chen SL. Current Interventions for the Left Main Bifurcation. *JACC Cardiovasc Interv.* 2017;10:849–65. [PubMed: 28473107]).
40. Allison B. Hall, MD1, Ivan Chavez, MD1, Santiago Garcia, MD1 at all. Double kissing crush bifurcation stenting: step-by-step troubleshooting. *EuroIntervention.* ; 17(4): e317–e325. doi:10.4244/EIJ-D-19-00721.
41. Kawasaki T, Koga H, Serikawa T, et al. Impact of a prolonged delivery inflation time for optimal drug-eluting stent expansion. *Catheter Cardiovasc Interv* 2009;73:205–11.
42. Mortier P, Hikichi Y, Foin N, De Santis G, Segers P, Verheghe B, De Beule M. Provisional stenting of coronary bifurcations: insights into final kissing balloon post-dilation and stent design by computational modeling. *JACC Cardiovasc Interv.* 2014;7:325–33.
43. Foin N, Torii R, Mortier P, De Beule M, Viceconte N, Chan PH, Davies JE, Xu XY, Krams R, Di Mario C. Kissing balloon or sequential dilation of the side branch and main vessel for provisional stenting of bifurcations: lessons from micro-computed tomography and computational simulations. *JACC Cardiovasc Interv.* 2012;5:47–56.
44. Qu, WB., Zhang, W., Liu, JY. et al. Modified balloon-stent kissing technique avoid side-branch compromise for simple true bifurcation lesions. *BMC Cardiovasc Disord* 19, 89 (2019). <https://doi.org/10.1186/s12872-019-1052-0>
45. Leyrat C, Seaman SR, White IR, Douglas I, Smeeth L, Kim J, Resche-Rigon M, Carpenter JR, Williamson EJ. Propensity score analysis with partially observed covariates: How should multiple imputation be used? *Stat Methods Med Res.* 2019;28:3–19. doi: 10.1177/0962280217713032
46. Austin PC. An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behav Res.* 2011;46:399–424. doi: 10.1080/00273171.2011.568786
47. Ziad Dahdouh, Bahaa M. Fadel, Vincent Roule, Antoine Sarkis, Gilles Grollier, Snuggle T and protrusion (S-TAP) technique for coronary bifurcation stenting: A step-by-step angiographic and illustration demonstration, *Cardiovascular Revascularization Medicine*, Volume 18, Issue 6, Supplement 1, 2017, Pages 14-16, ISSN 1553-8389, <https://doi.org/10.1016/j.carrev.2017.02.002>.
48. U. Speck, B. Scheller, C. Abramjuk, S. Grossmann, D. Mahnkopf, O. Simon Inhibition of restenosis in stented porcine coronary arteries: uptake of paclitaxel from angiographic contrast media *Invest Radiol*, 39 (2004), pp. 182-186
49. Raban V. Jeger, Simon Eccleshall, Wan Azman Wan Ahmad, Junbo Ge, Tudor C. Poerner, Eun-Seok Shin, Fernando Alfonso, Azeem Latib, Paul J. Ong, Tuomas T. Rissanen, Jorge Saucedo, Bruno Scheller, Franz X. Kleber, Drug-Coated Balloons for Coronary Artery Disease: Third Report of the International DCB Consensus Group, *JACC: Cardiovascular Interventions*, Volume 13, Issue 12, 2020, Pages 1391-1402, ISSN 1936-8798, <https://doi.org/10.1016/j.jcin.2020.02.043>.
50. Ge L, Airolidi F, Iakovou I, et al. Clinical and angiographic outcome after implantation of drug-eluting stents in bifurcation lesions with the crush stent technique: importance of final kissing balloon post-dilation. *J Am Coll Cardiol* 2005;46:613–20.
51. Hoye A, Iakovou I, Ge L, et al. Long-term outcomes after stenting of bifurcation lesions with the “crush” technique: predictors of an adverse outcome. *J Am Coll Cardiol* 2006;47:1949–58.
52. Jim MH, Ho HH, Chan AO, Chow WH. Stenting of coronary bifurcation lesions by using modified crush technique with double kissing balloon inflation (sleeve technique): immediate procedure result and short-term clinical outcomes. *Catheter Cardiovasc Interv* 2007;69: 969–75.
53. Chen SL, Zhang JJ, Ye F, et al. Study comparing the double kissing (DK) crush with classical crush for the treatment of coronary bifurcation lesions: the DKCRUSH-1 Bifurcation Study with drug-eluting stents. *Eur J Clin Invest* 2008;38:361–71.
54. Pan M, Medina A, Sua´rez de Lezo J, et al. Coronary bifurcation lesions treated with simple approach (from the Cordoba & Las Palmas [CORPAL] Kiss trial). *Am J Cardiol* 2011;107:1460–5.
55. Korn HV, Yu J, Ohlow MA, et al. Interventional therapy of bifurcation lesions: a TIMI flow guided concept to treat side branches in bifurcation lesions—a prospective randomized clinical study (Thueringer Bifurcation Study, THUEBIS study as pilot trial). *Circ Cardiovasc Interv* 2009;2:535–42.
56. Niemelä M, Kervinen K, Erglis A, et al. Randomized comparison of final kissing balloon dilatation versus no final kissing balloon dilatation in patients with coronary bifurcation lesions treated with main vessel stenting: the Nordic-Baltic bifurcation study III. *Circulation* 2011;123:79–86.