

26. BÖLÜM

DİSEKSİYONLARDA HAYVAN MODELLERİ

Salih GÜLER¹

İntima tabakasında hasar sonucunda damar duvarı katlarının araya giren kan sebebi ile akut olarak ayrılmasına diseksiyon denir (1). Günümüzde halen tedavisi zor, morbidite ve mortalitesi yüksek olan katastrofik bir hastalıktır. Aort üç tabakadan oluşmaktadır. En içte intima tabakası, ortada başlıca düz kas hücrelerinden oluşan media tabakası ve en dışta adventisya tabakası bulunmaktadır. Sıklıkla zemininde anevrizmal genişleme bulunan diseksiyon, intimal hasara bağlı oluşabileceği gibi damar duvarı içine kanama sonucunda da oluşabilmektedir (1).

Aort diseksiyonu ilk olarak 16. yy. ortalarında tarif edilmiştir ancak ilk net patolojik tanımlama 18. yy. ortalarında Morgagni tarafından yapılmıştır (2, 3). Diseksiyon terimi ilk olarak Maunoir tarafından 19. yy. başlarında kullanılmış ve birkaç yıl sonrasında Laennec tarafından dissekan anevrizma tanımı yapılmıştır (2, 4, 5). Hastalık her ne kadar tanımlanmış olsa da 20. yy. ortalarına kadar tedavi edilememiştir. İlk başarılı cerrahi tedavi 1955 yılında DeBakey tarafından yapılmıştır (6). Aort diseksiyonları asendan aortanın tutulup tutulmamasına bağlı olarak Tip A ve Tip B olarak sınıflandırılır (7). Günümüzde Tip A diseksiyonların tedavisi konvansiyonel cerrahi yöntemler ile yapılmaktadır. Endovasküler tedavilerin ortaya çıkması ile birlikte özellikle Tip B diseksiyon hastalarının da bu yöntemlerle tedavi edilmesi gündeme gelmiştir (8). Bu aşamada yeni endovasküler yöntemlerin geliştirilmesi ve hastalığın fizyopatolojisinin değerlendirilmesi amacıyla çeşitli hayvan modelleri oluşturulmuştur.

¹ Dr.Öğr. Üyesi Sivas Cumhuriyet Üniversitesi, Tıp Fakültesi, Kalp ve Damar Cerrahisi AD

kontrolü yapılmıřtır. ACT 200 sn'nin üzerinde olacak řekilde takip edilmiř ve gereęi halinde ek dozlar yapılmıřtır.

Endovasküler olarak başarılı yöntemler oluřturulmuřtur ancak bu yöntemlerin en önemli dezavantajı önemli derecede tecrübe gerektirmesi ve öğrenme sürecinin zor olmasıdır. Bunun dıřındaki dezavantajları oluřturulan intimal flep kalınlıęının tam olarak bilinmemesi ve diseksiyonun anevrizmal bir zeminde geliřmemesidir.

Tablo 6: Endovasküler yöntemler ile oluřturulan model örnekleri.

| Örnek çalışma | Tür | Ek bilgiler |
|--|-------|--|
| Razavi, M. K. ve arkadaşları (1998) (89). | Domuz | |
| Eggebrecht, H. ve arkadaşları (2006) (92). | Domuz | |
| Okuno, T. ve arkadaşları (2012) (91). | Domuz | |
| Boufi, M. ve arkadaşları (2018) (93). | Domuz | Tip A diseksiyon modeli oluřturulmuřtur. |
| El Batti, S. ve arkadaşları (2018) (94). | Koyun | Endovasküler makas kullanılarak fenestrasyon üzerinde çalışılmıřtır. |

KAYNAKLAR

1. Nienaber, C. A., Clough, R. E., Sakalihasan, N., Suzuki, T., Gibbs, R., Mussa, F., ... &Cheshire, N. (2016). Aortic dissection. *Nature Reviews Disease Primers*, 2(1), 1-18.
2. Clouse, W. D., Hallett, J. W., Schaff, H. V., Spittell, P. C., Rowland, C. M., Ilstrup, D. M., &Melton III, L. J. (2004, February). Acute aortic dissection: population-based incidence compared with degenerative aortic aneurysm rupture. In *Mayo Clinic Proceedings* (Vol. 79, No. 2, pp. 176-180). Elsevier.
3. Morgagni, G. (1829). *De sedibus et causis morborum per anatomen indagatis: libri quinque* (Vol. 5). Vossius.
4. Maunoir, J. P. (1802). *Mémoires physiologiques et pratiques sur l'anévrisme et la ligature des artères Paschoud*.
5. Laennec, R. T. (1819). *De l'auscultation mediate ou traité des maladies du poumon et du cœur, fondé principalement sur ce nouveau moyen d'auscultation* (Vol. 2). Brosson.
6. De Bakey, M. E., Cooley, D. A., &CreechJr, O. (1955). Surgical considerations of dissecting aneurysm of the aorta. *Annals of surgery*, 142(4), 586.
7. Erbel, R., Aboyans, V., Boileau, C., Bossone, E., Bartolomeo, R. D., ... &Gaemperli, O. (2014). 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of th adult TheTask Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC). *European heart journal*, 35(41), 2873-2926.
8. Yunoki, K., Uchida, H., Sano, S., &Shimizu, N. (1998). Effects of endoluminal stent-grafts on acute aortic dissection in dogs. *Acta medica Okayama*, 52(2), 89-95.

9. Nagashima, H., Uto, K., Sakomura, Y., Aoka, Y., Sakuta, A., Aomi, S., ... &Kasanuki, H. (2002). An angiotensin-converting enzyme inhibitor, not an angiotensin II type-1 receptor blocker, prevents β -aminopropionitrile monofumarate-induced aortic dissection in rats. *Journal of vascular surgery*, 36(4), 818-823.
10. Behmoaras, J., Slove, S., Seve, S., Vranckx, R., Sommer, P., &Jacob, M. P. (2008). Differential expression of lysyloxidases LOXL1 and LOX during growth and aging suggests specific roles in elastin and collagen fiber remodeling in rat aorta. *Rejuvenationresearch*, 11(5), 883-889.
11. Li, J. S., Li, H. Y., Wang, L., Zhang, L., &Jing, Z. P. (2013). Comparison of β -aminopropionitrile-induced aortic dissection model in rats by different administration and dosage. *Vascular*, 21(5), 287-292.
12. Nakashima, Y., &Sueishi, K. (1992). Alteration of elastic architecture in the lathyriticrat aorta impliest hepathogenesis of aortic dissecting aneurysm. *The American journal of pathology*, 140(4), 959.
13. Zhang, K., Pan, X., Zheng, J., Liu, Y., & Sun, L. (2020). SIRT1 protects against aortic dissection by regulating AP-1/decour in signaling-mediated PDCD4 activation. *Molecular Biology Reports*, 47(3), 2149-2159.
14. Zhang, L., Pei, Y. F., Wang, L., Liao, M. F., Lu, Q. S., Zhuang, Y. F., ... &Jing, Z. P. (2012). Dramatic decrease of aortic longitudinal elastic strength in a rat model of aortic dissection. *Annals of vascular surgery*, 26(7), 996-1001.
15. Jia, L. X., Zhang, W. M., Zhang, H. J., Li, T. T., Wang, Y. L., Qin, Y. W., ... &Du, J. (2015). Mechanical stretch-induced endoplasmic reticulum stress, apoptosis and inflammation contribute to thoracic aortic aneurysm and dissection. *The Journal of pathology*, 236(3), 373-383.
16. Ren, W., Liu, Y., Wang, X., Jia, L., Piao, C., Lan, F., &Du, J. (2016). β -Aminopropionitrile monofumarate inducesthoracicaorticdissection in C57BL/6 mice. *Scientificreports*, 6(1), 1-7.
17. Simpson, C. F., Kling, J. M., &Palmer, R. F. (1968). Theuse of propranolol for the protection of turkeys from the development of β -aminopropionitrile-induced aortic ruptures. *Angiology*, 19(7), 414-418.
18. Simpson, C. F., & Taylor, W. J. (1982). Effect of hydralazine on aortic rupture induced by B-aminopropionitrile in turkeys. *Circulation*, 65(4), 704-708.
19. Zhang, W. M., Liu, Y., Li, T. T., Piao, C. M., Liu, O., Liu, J. L., ... &Du, J. (2016). Sustainedactivation of ADP/P2ry12 signalinginduces SMC senescence contributing to thoracic aortic aneurysm/dissection. *Journal of molecularandcellularcardiology*, 99, 76-86.
20. Ren, W., Liu, Y., Wang, X., Piao, C., Ma, Y., Qiu, S., ... &Zheng, S. (2018). TheComplement C3a-C3aR Axis Promotes Development of Thoracic Aortic Dissection via Regulation of MMP2 Expression. *TheJournal of Immunology*, 200(5), 1829-1838.
21. Liu, H., Zheng, X., Zhang, L., Yang, X., Shao, Y., &Zhang, S. (2018). Bilateral superior cervical ganglionectomy attenuates the progression of β -aminopropionitrile-induced aortic dissection in rats. *Life sciences*, 193, 200-206.
22. Wang, S., Liu, Y., Zhao, G., He, L., Fu, Y., Yu, C., ... & Kong, W. (2018). Postnatal deficiency of ADAMTS1 ameliorates thoracic aortic aneurysm and dissection in mice. *Experimental Physiology*, 103(12), 1717-1731.
23. Aicher, B. O., Mukhopadhyay, S., Lu, X., Muratoglu, S. C., Strickland, D. K., &Uczian, A. A. (2018). Quantitative Micro-CT Analysis of Aortopathy in a Mouse Model of β -aminopropionitrile-induced AorticAneurysm and Dissection. *JoVE (Journal of VisualizedExperiments)*, (137), e57589.
24. Gao, Y., WanG, Z., Zhao, J., Sun, W., Guo, J., YanG, Z., ... &ZhenG, J. (2019). Involvement of B cells in the pathophysiology of β -aminopropionitrile-induced thoracic aortic dissection in mice. *Experimentalanimals*, 18-0170.
25. Jiang, Y. F., Guo, L. L., Zhang, L. W., Chu, Y. X., Zhu, G. L., Lu, Y., ... &Jing, Z. P. (2019). Localupregulation of interleukin-1 beta in aortic dissecting aneurysm: correlation with matrix metalloproteinase-2, 9 expression and biomechanical decrease. *Interactive Cardiovascular and ThoracicSurgery*, 28(3), 344-352.

26. Zhou, B., Li, W., Zhao, G., Yu, B., Ma, B., Liu, Z., ... & Zhang, X. (2019). Rapamycin prevents thoracic aortic aneurysm and dissection in mice. *Journal of Vascular Surgery*, 69(3), 921-932.
27. Yang, Y. Y., Li, L. Y., Jiao, X. L., Jia, L. X., Zhang, X. P., Wang, Y. L., ... & Qin, Y. W. (2020). Intermittent hypoxia alleviates β -aminopropionitrile monofumarate induced thoracic aortic dissection in C57BL/6 mice. *European Journal of Vascular and Endovascular Surgery*, 59(6), 1000-1010.
28. Pan, L., Lin, Z., Tang, X., Tian, J., Zheng, Q., Jing, J., ... & Li, Q. (2020). S-nitrosylation of plasmin-3exacerbates thoracic aortic dissection formation via endothelial barrier dysfunction. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 40(1), 175-188.
29. Mehta, P. K., & Griendling, K. K. (2007). Angiotensin II cell signaling: physiological and pathological effects in the cardiovascular system. *American Journal of Physiology-Cell Physiology*, 292(1), C82-C97.
30. Fry, J. L., Shiraishi, Y., Turcotte, R., Yu, X., Gao, Y. Z., Akiki, R., ... & Seta, F. (2015). Vascular Smooth Muscle Sirtuin-1 Protects Against Aortic Dissection During Angiotensin II-Induced Hypertension. *Journal of the American Heart Association*, 4(9), e002384.
31. Tieu, B. C., Lee, C., Sun, H., LeJeune, W., Recinos, A., Ju, X., ... & Brasier, A. R. (2009). An adventitial IL-6/MCP1 amplification loop accelerates macrophage-mediated vascular inflammation leading to aortic dissection in mice. *The Journal of clinical investigation*, 119(12), 3637-3651.
32. Eagleton, M. J., Xu, J., Liao, M., Parine, B., Chisolm, G. M., & Graham, L. M. (2010). Loss of STAT1 is associated with increased aortic rupture in an experimental model of aortic dissection and aneurysm formation. *Journal of vascular surgery*, 51(4), 951-961.
33. Schriefel, A. J., Collins, M. J., Pierce, D. M., Holzapfel, G. A., Niklason, L. E., & Humphrey, J. D. (2012). Remodeling of intramural thrombus and collagen in an Ang-II infusion ApoE^{-/-} model of dissecting aortic aneurysms. *Thrombosis research*, 130(3), e139-e146.
34. Ju, X., Ijaz, T., Sun, H., Ray, S., Lejeune, W., Lee, C., ... & Brasier, A. R. (2013). Interleukin-6-signal transducer and activator of transcription-3 signaling mediates aortic dissections induced by angiotensin II via the T-helper lymphocyte 17-interleukin 17 axis in C57BL/6 mice. *Arteriosclerosis, thrombosis, and vascular biology*, 33(7), 1612-1621.
35. Ito, S., Hashimoto, Y., Majima, R., Nakao, E., Aoki, H., Nishihara, M., ... & Hayashi, M. (2020). MRTF-A promotes angiotensin II-induced inflammatory response and aortic dissection in mice. *Plosone*, 15(3), e0229888.
36. Trachet, B., Fraga-Silva, R. A., Jacquet, P. A., Stergiopoulos, N., & Segers, P. (2015). Incidence, severity, mortality, and confounding factors for dissecting AAA detection in angiotensin II-infused mice: a meta-analysis. *Cardiovascular research*, 108(1), 159-170.
37. Son, B. K., Sawaki, D., Tomida, S., Fujita, D., Aizawa, K., Aoki, H., ... & Nagai, R. (2015). Granulocyte macrophage colony-stimulating factor is required for aortic dissection/intramural haematoma. *Nature communications*, 6(1), 1-12.
38. Kimura, T., Shiraishi, K., Furusho, A., Ito, S., Hirakata, S., Nishida, N., ... & Miyamoto, T. (2014). Tenascin C protects aorta from acute dissection in mice. *Scientific reports*, 4, 4051.
39. Saraff, K., Babamusta, F., Cassis, L. A., & Daugherty, A. (2003). Aortic dissection precedes formation of aneurysms and atherosclerosis in angiotensin II-infused, apolipoprotein E-deficient mice. *Arteriosclerosis, thrombosis, and vascular biology*, 23(9), 1621-1626.
40. Faugeron, J., Nematalla, H., Li, W., Clement, M., Robidel, E., Frank, M., ... & Hagege, A. (2013). Angiotensin II promotes thoracic aortic dissections and ruptures in Col3a1 haploinsufficient mice. *Hypertension*, 62(1), 203-208.
41. Fan, L. M., Douglas, G., Bendall, J. K., McNeill, E., Crabtree, M. J., Hale, A. B., ... & Choudhury, R. P. (2014). Endothelial cell-specific reactive oxygen species production increases susceptibility to aortic dissection. *Circulation*, 129(25), 2661-2672.
42. Martorell, S., Hueso, L., Gonzalez-Navarro, H., Collado, A., Sanz, M. J., & Piqueras, L. (2016). Vitamin D receptor activation reduces angiotensin-II-induced dissecting abdominal aortic

- aneurysm in apolipoprotein E-knock out mice. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 36(8), 1587-1597.
43. Trachet, B., Aslanidou, L., Piersigilli, A., Fraga-Silva, R. A., Sordet-Dessimoz, J., Villanueva-Perez, P., ... & Segers, P. (2017). Angiotensin II infusion into ApoE^{-/-} mice: a model for aortic dissection rather than abdominal aortic aneurysm?. *Cardiovascular Research*, 113(10), 1230-1242.
 44. Wang, Y., Yin, P., Chen, Y. H., Yu, Y. S., Ye, W. X., Huang, H. Y., ... & Shen, Z. Y. (2018). A functional variant of SMAD4 enhances macrophage recruitment and inflammatory response via TGF- β signal activation in Thoracic aortic aneurysm and dissection. *Aging (Albany NY)*, 10(12), 3683.
 45. Adelsperger, A. R., Phillips, E. H., Ibriga, H. S., Craig, B. A., Green, L. A., Murphy, M. P., & Goergen, C. J. (2018). Development and growth trends in angiotensin II-induced murine dissecting abdominal aortic aneurysms. *Physiological Reports*, 6(8), e13668.
 46. LeMaire, S. A., Zhang, L., Luo, W., Ren, P., Azares, A. R., Wang, Y., ... & Shen, Y. H. (2018). Effect of ciprofloxacin on susceptibility to aortic dissection and rupture in mice. *JAMA Surgery*, 153(9), e181804-e181804.
 47. Zhang, L., Zhou, J., Jing, Z., Xiao, Y., Sun, Y., Wu, Y., & Sun, H. (2018). Glucocorticoids regulate the vascular remodeling of aortic dissection via the p38 MAPK-HSP27 pathway mediated by soluble TNF-RII. *EBioMedicine*, 27, 247-257.
 48. Zhang, L., Wang, C., Xi, Z., Li, D., & Xu, Z. (2018). Mercaptoethanol protects the aorta from dissection by inhibiting oxidative stress, inflammation, and extracellular matrix degeneration in a mouse model. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, 24, 1802.
 49. Huang, X., Yue, Z., Wu, J., Chen, J., Wang, S., Wu, J., ... & Wu, C. (2018). MicroRNA-21 knock out exacerbates angiotensin II-induced thoracic aortic aneurysm and dissection in mice with abnormal transforming growth factor- β -SMAD3 signaling. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 38(5), 1086-1101.
 50. Ohno-Urabe, S., Aoki, H., Nishihara, M., Furusho, A., Hirakata, S., Nishida, N., ... & Akashi, H. (2018). Role of macrophage Socs3 in the pathogenesis of aortic dissection. *Journal of the American Heart Association*, 7(2), e007389.
 51. Clément, M., Chappell, J., Raffort, J., Lareyre, F., Vandestienne, M., Taylor, A. L., ... & Taleb, S. (2019). Vascular smooth muscle cell plasticity and autophagy in dissecting aortic aneurysms. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 39(6), 1149-1159.
 52. Zou, S., Ren, P., Zhang, L., Azares, A. R., Zhang, S., Coselli, J. S., ... & LeMaire, S. A. (2020). Activation of Bone Marrow-Derived Cells and Resident Aortic Cells During Aortic Injury. *Journal of Surgical Research*, 245, 1-12.
 53. Kurihara, T., Shimizu-Hirota, R., Shimoda, M., Adachi, T., Shimizu, H., Weiss, S. J., ... & Okada, Y. (2012). Neutrophil-derived matrix metalloproteinase 9 triggers acute aortic dissection. *Circulation*, 126(25), 3070-3080.
 54. Ren, W., Wang, Z., Wang, J., Wu, Z., Ren, Q., Yu, A., & Ruan, Y. (2020). IL-5 overexpression attenuates aortic dissection by reducing inflammation and smooth muscle cell apoptosis. *Life Sciences*, 241, 117144.
 55. Hirakata, S., Aoki, H., Ohno-Urabe, S., Nishihara, M., Furusho, A., Nishida, N., ... & Hiro-matsu, S. (2020). Genetic deletion of Socs3 in smooth muscle cells ameliorates aortic dissection in mice. *JACC: Basic to Translational Science*, 5(2), 126-144.
 56. Izawa-Ishizawa, Y., Imanishi, M., Zamami, Y., Toya, H., Nagao, T., Morishita, M., ... & Ikeda, Y. (2019). Development of a novel aortic dissection mouse model and evaluation of drug efficacy using in-vivo assays and database analyses. *Journal of Hypertension*, 37(1), 73-83.
 57. Tomida, S., Aizawa, K., Nishida, N., Aoki, H., Imai, Y., Nagai, R., & Suzuki, T. (2019). Indomethacin reduces rates of aortic dissection and rupture of the abdominal aorta by inhibiting monocyte/macrophage accumulation in a murine model. *Scientific Reports*, 9(1), 1-12.

58. Nishida, N., Aoki, H., Ohno-Urabe, S., Nishihara, M., Furusho, A., Hirakata, S., ... & Yasukawa, H. (2020). High salt intake worsens aortic dissection in mice: involvement of IL (interleukin)-17A-dependent ECM (extracellularmatrix) metabolism. *Arteriosclerosis, thrombosis, andvascularbiology*, 40(1), 189-205.
59. Hayashi-Hori, M., Aoki, H., Matsukuma, M., Majima, R., Hashimoto, Y., Ito, S., ... & Fukumoto, Y. (2020). Therapeutic Effect of Rapamycin on Aortic Dissection in Mice. *International journal of molecularsciences*, 21(9), 3341.
60. Blanton Jr, F. S. (1959). Experimental production of dissecting aneurysms of the aorta. *Surgery*, 45, 81-90.
61. Marty-Ané, C. H., SerreCousiné, O., Laborde, J. C., Costes, V., Mary, H., &Senac, J. P. (1995). Use of a balloon-expandable intravascular graft in the management of type B aortic dissection in an animal model. *Journal of Vascular and Interventional Radiology*, 6(1), 97-103.
62. Tanabe, T., Hashimoto, M., Sakai, K., Yasuda, K., Takeoka, T., Matsunami, O., ... &Gohda, T. (1986). Surgical treatment of aortic dissection: application of Ivalonsponge to the dissected lumen. *TheAnnals of thoracicsurgery*, 41(2), 169-175.
63. Sénémaud, J., Caligiuri, G., Etienne, H., Delbosc, S., Michel, J. B., &Coscas, R. (2017). Translational relevance and recent advances of animal models of abdominal aortic aneurysm. *Arteriosclerosis, thrombosis, andvascularbiology*, 37(3), 401-410.
64. Kato, M., Matsuda, T., Kaneko, M., Ueda, T., Kuratani, T., Yoshioka, Y., &Ohnishi, K. (1995). Experimental assessment of newly devised transcatheter stent-graft for aortic dissection. *TheAnnals of thoracicsurgery*, 59(4), 908-915.
65. Tang, J., Wang, Y., Hang, W., Fu, W., &Jing, Z. (2010). Controllable and uncontrollable Stanford type B aortic dissection in canine models. *EuropeanSurgicalResearch*, 44(3-4), 179-184.
66. Terai, H., Tamura, N., Yuasa, S., Nakamura, T., Shimizu, Y., &Komeda, M. (2005). An experimental model of Stanford type B aorticdissection. *Journal of vascular and interventional radiology*, 16(4), 515-519.
67. Cui, J. S., Zhuang, S. J., Zhang, J., Mei, Z. J., Jing, Z. P., &Liao, M. F. (2009). Two-end intimal flap suturing method for establishing Stanford B type aortic dissection in a canine model. *European Journal of VascularandEndovascularSurgery*, 38(5), 603-607.
68. Li, M., Luo, N., Bai, Z., Wang, S., &Shi, Y. (2012). A canine model of multiple organ dysfunction following acute type-A aortic dissection. *Surgerytoday*, 42(9), 876-883.
69. Fujii, H., Tanigawa, N., Okuda, Y., Komemushi, A., Sawada, S., &Imamura, H. (2000). Creation of aortic dissection model in swine. *Japanesecirculationjournal*, 64(9), 736-737.
70. Kahler, R. J., &Stuart, G. S. (1998). Internal carotid artery dissection: an animal model?. *Journal of InvestigativeSurgery*, 11(1), 63-68.
71. Morales, D. L., Quin, J. A., Braxton, J. H., Hammond, G. L., Gusberg, R. J., &Elefteriades, J. A. (1998). Experimental confirmation of effectiveness of fenestration in acute aortic dissection. *TheAnnals of thoracicsurgery*, 66(5), 1679-1683.
72. Terai, H., Tamura, N., Nakamura, T., Nishimura, K., Tsutsui, N., Shimizu, Y., &Komeda, M. (2000). Treatment of acute Stanford type B aortic dissection with a novel cylindrical balloon catheter in dogs. *Circulation*, 102(suppl_3), Iii-259.
73. Fujita, M., Morimoto, Y., Ohmori, S., Usami, N., Arai, T., Maehara, T., &Kikuchi, M. (2003). Preliminary study of laser welding for aortic dissection in a porcine model using a diode laser with indocyanine green. *Lasers in Surgery and Medicine: The Official Journal of the American Society for Laser Medicine and Surgery*, 32(5), 341-345.
74. Zimpfer, D., Schima, H., Czerny, M., Kasimir, M. T., Sandner, S., Seebacher, G., ... &Ehrlich, M. (2008). Experimental stent-graft treatment of ascending aortic dissection. *The Annals of thoracic surgery*, 85(2), 470-473.
75. Matt, P., Huso, D. L., Habashi, J., Holm, T., Doyle, J., Schoenhoff, F., ... &Dietz, H. C. (2010). Murine model of surgically induced acute aortic dissection type A. *The Journal of thoracic and cardiovascular surgery*, 139(4), 1041-1047.

76. Dziodzio, T., Juraszek, A., Reineke, D., Jenni, H., Zermatten, E., Zimpfer, D., ... & Czerny, M. (2011). Experimental acute type B aortic dissection: different sites of primary entry tears cause different ways of propagation. *The Annals of thoracic surgery*, 91(3), 724-727.
77. Sato, M., Kawamoto, S., Watanabe, M., Sakamoto, N., Sato, M., Tabata, Y., & Saiki, Y. (2012). Medial regeneration using a biodegradable felt as a scaffold preserves integrity and compliance of a canine dissected aorta. *Circulation*, 126(11_suppl_1), S102-S109.
78. Wang, L. X., Wang, Y. Q., Guo, D. Q., Jiang, J. H., Zhang, J., Cui, J. S., & Fu, W. G. (2013). An experimental model of Stanford type B aortic dissection with intravenous epinephrine injection. *The Kaohsiung Journal of Medical Sciences*, 29(4), 194-199.
79. Qin, C., Zhang, H., Gu, J., Xiao, Z., Yang, Q., & Meng, W. (2016). Dynamic monitoring of platelet activation and its role in post-dissection inflammation in a canine model of acute type A aortic dissection. *Journal of Cardiothoracic Surgery*, 11(1), 86.
80. Sun, J. M., Wang, S. M., Shi, T. X., Zhao, Y., & Shi, D. (2016). Establishment of a dog aortic dissection model and treatment by film-covered stent grafting. *INTERNATIONAL JOURNAL OF CLINICAL AND EXPERIMENTAL MEDICINE*, 9(7), 12949-12953.
81. Guo, B., Dong, Z., Pirola, S., Liu, Y., Menichini, C., Xu, X. Y., ... & Fu, W. (2019). Dissection Level Within Aortic Wall Layers is Associated with Propagation of Type B Aortic Dissection: A Swine Model Study. *European Journal of Vascular and Endovascular Surgery*, 58(3), 415-425.
82. Shen, Y., Rao, W., Liu, J., Zhu, G., Chen, Z., Song, C., ... & Jing, Z. (2019). A Promising Treatment of Distal Entry Tears Located in Branched Area of Abdominal Aorta With Coil-Stent Tear Occlusion Device: an Animal Experiment. *Journal of cardiovascular translational research*, 12(4), 338-346.
83. Qiao, F., Su, C., Han, Q., Tan, M., Wang, J., Liu, Y., ... & Xu, Z. (2018). Hybrid reconstruction of the aortic arch using a double-branched stent-graft in a canine model. *Journal of Investigative Surgery*.
84. Faure, E. M., Canaud, L., Cathala, P., Serres, I., Marty-Ané, C., & Alric, P. (2014). Human ex-vivo model of Stanford type B aortic dissection. *Journal of Vascular Surgery*, 60(3), 767-775.
85. Faure, E. M., Canaud, L., Cathala, P., Serres, I., Marty-Ané, C., & Alric, P. (2015). Assessment of abdominal branch vessel patency after bare-metal stenting of the thoracoabdominal aorta in a human ex vivo model of acute type B aortic dissection. *Journal of Vascular Surgery*, 61(5), 1299-1305.
86. Qing, K. X., Chan, Y. C., Lau, S. F., Yiu, W. K., Ting, A. C. W., & Cheng, S. W. K. (2012). Ex-vivo haemodynamic models for the study of Stanford type B aortic dissection in isolated porcine aorta. *European Journal of Vascular and Endovascular Surgery*, 44(4), 399-405.
87. Veger, H. T. C., Pasveer, E. H., & Visser, M. J. T. (2017). Where to Fenestrate in Aortic Dissection Type B? An Ex Vivo Study. *Annals of vascular surgery*, 43, 296-301.
88. Veger, H. T., Pasveer, E. H., Westenberg, J. J., Wever, J. J., & van Eps, R. G. S. (2020). The Influence of Aortic Wall Elasticity on the False Lumen in Aortic Dissection: An In Vitro Study. *Vascular and Endovascular Surgery*, 54(7), 592-597.
89. Razavi, M. K., Nishimura, E., Slonim, S., Zeigler, W., Kee, S., Witherall, H. L., ... & Dake, M. D. (1998). Percutaneous creation of acute type-B aortic dissection: an experimental model for endoluminal therapy. *Journal of vascular and interventional radiology*, 9(4), 626-632.
90. Eggebrecht, H., Heusch, G., Erbel, R., Ladd, M. E., & Quick, H. H. (2007). Real-time vascular interventional magnetic resonance imaging. *Basic research in cardiology*, 102(1), 1-8.
91. Okuno, T., Yamaguchi, M., Okada, T., Takahashi, T., Sakamoto, N., Ueshima, E., ... & Sugimoto, K. (2012). Endovascular creation of aortic dissection in a swine model with technical considerations. *Journal of vascular surgery*, 55(5), 1410-1418.
92. Eggebrecht, H., Kühl, H., Kaiser, G. M., Aker, S., Zenge, M. O., Stock, F., ... & Erbel, R. (2006). Feasibility of real-time magnetic resonance-guided stent-graft placement in a swine model of descending aortic dissection. *European heart journal*, 27(5), 613-620.

93. Boufi, M., Claudel, M., Dona, B., Djemli, A., Branger, N., Berdah, S., & Alimi, Y. S. (2018). Endovascular creation and validation of acute in vivo animal model for type A aortic dissection. *journal of surgicalresearch*, 225, 21-28.
94. El Batti, S., Abdallah, I. B., Dufetelle, E., Julia, P., Menasche, P., & Alsac, J. M. (2018). Experimental evaluation of endovascular fenestration scissors in an ovine model of aortic dissection. *European Journal of Vascular and Endovascular Surgery*, 56(3), 373-380.