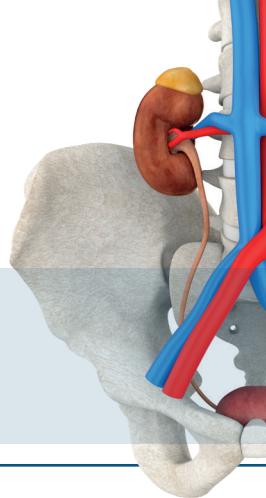


BÖLÜM 1

ADRENAL GLAND PATOLOJİLERİ 1

Melike ŞENER SORGUN¹



ANATOMİ VE GÖRÜNTÜLEME YÖNTEMLERİ

Giriş

Adrenal bezleri ilk defa, 1552 yılında İtalyan anatomist Bartolomeo Eustachia, "glandulae renis incumbentes" (glands lying on the kidney) ifadesiyle tanımlamıştır. Hızlı otolize uğradığından otopsilerde adrenal bezler kapsül şeklinde görürlüler. Bu sebeple, 17-19. yüzyılda "suprarenal kapsül" olarak isimlendirilmiştir (1).

Embriyoloji

Adrenal bez dual embriyolojik kökene sahiptir. Dışta mezodermden kaynaklanan bir korteks ve santralde nöral krestten kaynaklanan medulladan oluşmaktadır. Adrenal bezin embriyolojik gelişimi sırasında korteks ve medulla, özellikle paraaortik alanda, mediastende, mesanede ve vaginal alanlarda aksesuar hücre toplulukları oluşturabilir. Adrenokortikal kalıntılarla en sık olarak adrenal bezlerin çevresinde, böbrek içinde, overde, over pedikülünde ve testiste rastlanır. Anormal lokalizasyonlu adrenal korteksin 3 adet klinik önemi vardır: (2)

1. Adrenalektomiden sonra bu kaynaklardan adrenal aktivite devam edebilir.
2. Anormal lokalizasyonlu normal bezlerin nefrektomi sırasında çıkarılmasıyla adrenal yetmezlik gelişebilir.
3. Neoplastik oluşumlar gelişebilir.

Adrenal bezin ağırlık olarak yaklaşık %90'ını korteks, geri kalanını medulla oluşturmaktadır. Bu iki tabaka, embriyolojik, histolojik, anatominik, ve sekretuar açıdan birbirinden tamamen farklıdır. Korteks steroid sentezi yapar, glandın periferinde-kapsül altında bulunur. Medulla ise katekolamin sentezleyen ve adrenal bezin santralini oluşturan parçadır. Adrenal korteks, hücrelerin diziliş temeline göre 3 ayrı zona ayrılır: Zona glomeruloza, zona fasikülata ve zona retikularis.

Anatomı

Adrenal bezler, perirenal boşlukta, böbreklerin üst polünün hemen anterosuperiorunda yer alan ve kendine ait gerçek bir kapsüle sahip olan iki adet organdır. Gövde ve medial/lateral olmak üzere iki krustan oluşur. Krusun genişliği, aksiyel düzlemede uzun eksene dik olarak ölçüldüğünde

¹ Uzm. Dr., İzmir Bakırçay Üniversitesi Eğitim ve Araştırma Hastanesi Radyoloji AD., melike.sener@hotmail.com

metastazları adenomlardan ayırmada sınırlamları vardır (126).

Primer malignitesi bilinen hastalarda, bilateral adrenal metastazların tanısı genellikle biyopsi ve belirli bir kesinlikte görüntüleme ile konur. İçerdeği riskler nedeniyle, perkutan iğne biyopsisi yapmak istendiğinde, histopatolojik tanımlamanın, tedavi veya прогноз üzerinde önemli bir etkisi olup olmayacağı belirlenmesi gereklidir.

PET-BT'nin adrenal metastazı saptamadaki tanışal gücü sınırlıdır. Adrenal kortikal hiperplazi, adenomlar ve endotelyal kistler gibi lezyonlar yanlış pozitiflik gösterebilir ve metastaz olarak yorumlanabilir.

Kısaltmalar:



USG : Ultrasonografi

BT : Bilgisayarlı tomografi

MRG : Manyetik rezonans görüntüleme

T1A : T1 ağırlıklı

T2A : T2 ağırlıklı

DAG : Difüzyon ağırlıklı görüntüleme

ADC : Apperent diffusion coefficient

FDG : Florodeoksiglukoz

SII : Adrenal duyarlılık indeksi

ASR : Adrenal-dalak kimyasal sift oranı

CSI : Kimyasal sift görüntüleme

5. Pedullà G, Crocetti D, Paliotta A, et al. Surgical Treatment of Pheochromocytoma in MEN 2. *Ann. Ital. Chir.* 2014;85:443–447.
6. Wang F, Liu J, Zhang R, et al. CT and MRI of adrenal gland pathologies. *Quantitative Imaging in Medicine and Surgery*. 2018;8(8):853-875.
7. Kangarloo H, Diament MJ, Gold RH, et al. Sonography of adrenal glands in neonates and children: changes in appearance with age. *J Clin Ultrasound*. 1986;14(1):43-47.
8. Dunnick NR, Korobkin M, Francis I. Adrenal radiology: distinguishing benign from malignant adrenal masses. *Am J Roentgenol*. 1996;167(4):861-867.
9. Johnson PT, Horton KM, Fishman EK. Adrenal mass imaging with multidetector CT: pathologic conditions, pearls, and pitfalls. *Radiographics*. 2009; <https://doi.org/10.1148/rq.295095027>.
10. Cirillo RL Jr, Bennett WF, Vitellas KM, et al. Pathology of the adrenal gland: imaging features. *Am J Roentgenol* 1998;170:429-435.
11. Taffel M, Haji-Momenian S, Nikolaidis P, et al. Adrenal imaging: a comprehensive review. *Radiol Clin North Am* 2012;50:219-243.
12. Marin D, Dale BM, Bashir MR, et al. Effectiveness of a three-dimensional dual gradient echo two-point Dixon technique for the characterization of adrenal lesions at 3 Tesla. *Eur Radiol* 2012;22:259-268.
13. d'Amuri FV, Maestroni U, Pagnini F, et al. Magnetic resonance imaging of adrenal gland: state of the art. *Gland Surg* 2019;8:223-232.
14. Melo HJ, Goldman SM, Szeinfeld J, et al. Application of a protocol for magnetic resonance spectroscopy of adrenal glands: an experiment with over 100 cases. *Radiol Bras* 2014;47:333-341.
15. Blake MA, Cronin CG, Boland GW. Adrenal imaging. *Am J Roentgenol* 2010;194:1450-1460.
16. Kantarcı M, Serter A, Guven F, Kocakoc E. Adrenal. In: Kocakoc E (ed). *Abdominal radyoloji*. Ankara: Dünya Tip Kitabevi; 2014. 431-464.
17. Dunnick NR, Korobkin M. Imaging of adrenal incidentalomas: current status. *AJR* 2002;179:559-568.
18. Shin YR, Kim KA. Imaging features of various adrenal neoplastic lesions on radiologic and nuclear medicine imaging. *AJR* 2015;205:554-263.
19. Helck A, Hummel N, Meinel FG, et al. *Eur Radiol*. 2014;24(7):1636-1642.
20. Seo JM, Park BK, Park SY, Kim CK. Characterization of lipid-poor adrenal adenoma: chemical-shift MRI and washout CT. *Am J Roentgenol*. 2014;202(5):1043-1050
21. Ream JM, Gaing B, Mussi TC, et al. Characterization of Adrenal Lesions at Chemical-Shift MRI: A Direct Intraindividual Comparison of in- and Opposed-Phase Imaging at 1.5 T and 3 T. *AJR* 2015, 204, 536-541.
22. Benitah N, Yeh BM, Qayyum A, et al. Minor Morphologic Abnormalities of Adrenal Glands at CT: Prognostic Importance in Patients with Lung Cancer. *Radiology* 2005;235:517-522.

KAYNAKLAR

1. Welbourn RB (ed). *Anonymous the history of endocrine surgery*. New York: Praeger; 1990: 147-210.
2. Schechter DC. Aberrant adrenal tissue. *Ann Surg* 1968;167:421-426.
3. Cerny JC. Anatomy of the adrenal gland. *Urol Clin North Am* Jun 1977;4(2):169-177.
4. Mayo-Smith WW, Song JH, Boland GL, et al. Management of incidental adrenal masses: a White Paper of the ACR Incidental Findings Committee. *J Am Coll Radiol*. 2017; <https://doi.org/10.1016/j.jacr.2017.05.001>.

23. Metser U, Miller E, Lerman H, et al. 18F-FDG PET/CT in the evaluation of adrenal masses. *J Nucl Med*. 2006;47(1): 32-37.
24. Park BK, Kim B, Ko K, et al. Adrenal masses falsely diagnosed as adenomas on unenhanced and delayed contrast-enhanced computed tomography: pathological correlation. *Eur Radiol*. 2006;16(3):642-647.
25. Abeshouse GA, Goldstein RB, Abeshouse BS. Adrenal cysts; review of the literature and report of three cases, *J Urol* 1959;81:711-719.
26. Erickson LA, Lloyd RV, Hartman R, et al. Cystic adrenal neoplasms. *Cancer*. 2004;101(7):1537-1544.
27. Mohiuddin Y, Gilliland MGF. Adrenal Schwannoma: A Rare Type of Adrenal Incidentaloma. *Arch. Pathol. Lab. Med.* 2013;137:1009-1014.
28. Bellantone R, Ferrante A, Raffaelli M, et al. Adrenal cystic lesions: report of 12 surgically treated cases and review of the literature. *J Endocrinol Invest. f'evr.* 1998;21(2):109-114.
29. Ctvrtlik F, Koranda P, Tichy T. Adrenal Disease: A Clinical Update and Overview of Imaging. A Review. *Biomed. Pap. Med. Fac. Univ. Palacky Olomouc Czech Repub.* 2014;158:23-34.
30. Mohan H, Aggarwal R, Tahlan A, et al. Giant adrenal pseudocyst mimicking a malignant lesion, *Can J Surg* 2003;46:474.
31. Carvounis E, Marinis A, Arkadopoulos N, et al. Vascular adrenal cysts: a brief review of the literature, *Arch Pathol Lab Med* 2006;130:1722-1724.
32. Tunçer İ, Gönlüßen G, Ersöz C, et al. Adrenal gland kisti: Dört vakada klinikopatolojik değerlendirme. [Adrenal gland cyst: A clinicopathologic study of four cases.] *Çağdaş Cerrahi Dergisi* 1995;9:49-52.
33. Lockhart ME, Smith JK, Kenney PJ. Imaging of adrenal masses. *Eur J Radiol. f'evr.* 2002;41(2):95-112.
34. Sanal HT, Kocaoglu M, Yildirim D, et al. Imaging features of benign adrenal cysts. *Eur J Radiol*. 2006;60(3):465-469.
35. Elsayes KM, Mukundan G, Narra VR, et al. Adrenal masses: mr imaging features with pathologic correlation. *Radiographics*. 2004;24 Suppl 1:73-86.
36. Tatar H, Bilgi S, Sanal M. Yenidoğan Döneminde Adrenal Hemorajik Kist. *Çocuk Dergisi* 2013;13(2):81-84.
37. Pradeep PV, Mishra AK, Aggarwal V, et al. Adrenal cysts: an institutional experience, *World J Surg* 2006;30:1817-1820.
38. Sanal HT, Kocaoglu M, Yildirim D, et al. Imaging features of benign adrenal cysts. *Eur J Radiol*. 2006;60(3):465-469.
39. Ricci Z, Cheryak V, Hsu K, et al. Adrenal cysts: natural history by long-term imaging follow-up. *Am J Roentgenol* 2013;201:1009-1016.
40. Rozenblit A, Morehouse HT, Amis ES Jr: Cystic adrenal lesions: CT features. *Radiology* 1996; 201:541-548.
41. Kumar N, Singh S, Govil S. Adrenal histoplasmosis: clinical presentation and imaging features in nine cases. *Abdom Imaging* 2003;28:703-708.
42. Doherty S. Fatal pneumococcal Waterhouse—Frideri- chsen syndrome. *Emerg Med* 2001;13:237-239.
43. Kawashima A, Sandler CM, Ernst RD, et al. Imaging of nontraumatic hemorrhage of the adrenal gland. *Radiographics*. 1999;19(4):949-963.
44. Toti MS, Ghirri P, Bartoli A, et al. Adrenal hemorrhage in newborn: how, when and why- from case report to literature review. *Ital J Pediatr* 2019;45:58.
45. Sayit AT, Sayit E, Gunbey HP, et al. Imaging of unilateral adrenal hemorrhages in patients after blunt abdominal trauma: report of two cases. *Chin J Traumatol* 2017;20:52-55.
46. Soto JA, Anderson SW. Multidetector CT of blunt abdominal trauma. *Radiology* 2012;265:678-693.
47. Lattin Jr GE, Sturgill ED, Tujo CA, et al. From the Radiologic Pathology Archives: Adrenal Tumors and Tumor-like Conditions in the Adult: Radiologic Pathologic Correlation. *Radiographics*. 2014;34(3):805-829.
48. Karwacka IM, Obołończyk Łukasz, Sworczak K. Adrenal hemorrhage: a single center experience and literature review. *Adv Clin Exp Med* 2018;27:681-687.
49. Jordan E, Poder L, Courtier J, et al. Imaging of nontraumatic adrenal hemorrhage. *Am J Roentgenol* 2012;199:91-98.
50. Badawy M, Gaballah AH, Ganeshan D, et al. Adrenal hemorrhage and hemorrhagic masses; diagnostic workup and imaging findings. *Br J Radiol*. 2021;94(1127):20210753.
51. Chong YL, Green JA, Toh KL, et al. Laparoscopic drainage of nocardial adrenal abscess in an HIV positive patient. *Int J Urol*. 2004;11:547-549.
52. Jackson C, McCullar B, Joglekar K, et al. Disseminated Nocardia Farcinica Pneumonia with Left Adrenal Gland Abscess. *Cureus* 2017;9:e1160.
53. Jin W, Miao Q, Wang M, et al. A rare case of adrenal gland abscess due to anaerobes detected by metagenomic next-generation sequencing. *Annals of Translational Medicine*, 2020;8(5):247.
54. Hönigschnabl S, Gallo S, Niederle B, et al. How accurate is MR imaging in characterisation of adrenal masses: update of a long-term study. *Eur J Radiol*. 2002;41:113-122.
55. Guo YK, Yang ZG, Li Y, et al. Uncommon adrenal masses: CT and MRI features with histopathologic correlation. *Eur J Radiol*. 2007;62:359-370.
56. Agrons MM, Jensen CT, Habra MA, et al. Adrenal cortical hyperplasia: diagnostic workup, subtypes, imaging features and mimics. *Br J Radiol*. 2017;90(1079):20170330.
57. Galia M, Albano D, Bruno A, et al. Imaging features of solid renal masses. *Br J Radiol*. 2017;90(1077):20170077.
58. Shetty AS, Sipe AL, Zulfiqar M, et al. In-Phase and Opposed-Phase Imaging: Applications of Chemical Shift and Magnetic Susceptibility in the Chest and Abdomen. *Radiographics* 2019;39: 115-135.
59. Zeiger MA, Thompson GB, Duh QY, et al. American Association of Clinical Endocrinologists; American Association of Endocrine Surgeons American Association of Clinical Endocrinologists and American Association of Endocrine Surgeons Medical Guidelines for the Management of Adrenal Incidentalomas: Exe-

- cutive Summary of Recommendations. *Endocr. Pract.* 2009;15: 450–453.
60. Albano D, Agnello F, Midiri F, et al. Imaging Features of Adrenal Masses. *Insights Imaging* 2019;10:1.
 61. Tang YZ, Bharwani N, Micco M, et al. The prevalence of incidentally detected adrenal enlargement on CT. *Clin Radiol*, 2014;69(1):37-42.
 62. Rockall AG, Babar SA, Sohaib SAA, et al. CT and MR Imaging of the Adrenal Glands in ACTH-Independent Cushing Syndrome. *Radiographics* 2004;24:435–452.
 63. Vincent JM, Morrison ID, Armstrong P, et al. The size of normal adrenal glands on computed tomography. *Clin Radiol*, 1994;49(7):453-455.
 64. Sivit CJ, Hung W, Taylor GA, et al. Sonography in neonatal congenital adrenal hyperplasia. *Am J Roentgenol* 1991;156:141-143.
 65. Avni EF, Rypens F, Smet MH, et al. Sonographic demonstration of congenital adrenal hyperplasia in the neonate: the cerebriform pattern. *Pediatr Radiol* 1993;23:88-90.
 66. Park SY, Park BK, Park JJ, et al. Differentiation of adrenal hyperplasia from adenoma by use of CT densitometry and percentage washout. *Am J Roentgenol*. 2016;206(1):106-112.
 67. Lumachi F, Zucchetto P, Marzola MC, et al. Usefulness of CT scan, MRI and radiocholesterol scintigraphy for adrenal imaging in Cushing's syndrome. *Nucl Med Commun.* 2002;23(5):469-73.
 68. Michelle MA, Jensen CT, Habra MA, et al. Adrenal Cortical Hyperplasia: Diagnostic Workup, Subtypes, Imaging Features and Mimics. *Br. J. Radiol.* 2017;90:20170330.
 69. Terzolo M, Stigliano A, Chiodini I, et al. AME position statement on adrenal incidentaloma. *Eur J Endocrinol.* 2011;164(6):851-870.
 70. Cawood TJ, Hunt PJ, O'Shea D, et al. Recommended evaluation of adrenal incidentalomas is costly, has high false-positive rates and confers a risk of fatal cancer that is similar to the risk of the adrenal lesion becoming malignant; time for a rethink? *Eur J Endocrinol.* 2009;161(4):513–527.
 71. Freda PU, Wardlaw SL, Brudney K, et al. Primary adrenal insufficiency in patients with the acquired immunodeficiency syndrome: a report of five cases. *J Clin Endocrinol Metab.* 1994;79(6):1540–1545.
 72. Kumar N, Singh S, Govil S. Adrenal histoplasmosis: clinical presentation and imaging features in nine cases. *Abdom Imaging* 2003;28:703-708.
 73. Patnaik MM, Deshpande AK. Diagnosis Addison's disease secondary to tuberculosis of the adrenal glands. *Clin Med Res.* 2008;6:29.
 74. Guo YK, Yang ZG, Li Y, et al. Addison's disease due to adrenal tuberculosis: contrast-enhanced CT features and clinical duration correlation. *Eur J Radiol.* 2007;62:126-131.
 75. Efremidis SC, Harsoulis F, Douma S, et al. Adrenal insufficiency with enlarged adrenals. *Abdom Imaging*. 1996;21:168-171.
 76. Yang ZH, Guo YK, Li Y, et al. Differentiation between tuberculosis and primary tumors in the adrenal gland: evaluation with contrast-enhanced CT. *Eur Radiol.* 2006;16:2031-2036.
 77. Kathuria S, Kapoor MR, Yadav S, et al. Disseminated histoplasmosis in an apparently immunocompetent individual from north India: a case report and review, *Med Mycol.* 2013;51: 774–778.
 78. Paolo WF, Nosanchuk JD. Adrenal infections, *Int J. Infect. Dis.* 2006;10:66–71.
 79. Bhansali A, Das S, Dutta P, et al. Adrenal histoplasmosis: unusual presentations, *J. Assoc. Physicians India* 2012;60:54–58.
 80. Blake MA, Cronin CG, Bolan GW. Adrenal imaging. *AJR* 2010;194:1450-1460.
 81. Mitchell IC, Nwariaku FE. Adrenal masses in the cancer patients: surveillance or excision. *Oncologist* 2007;12:168-174.
 82. Lam KY, Lo CY. Metastatic tumours of the adrenal glands: a 30-year experience in a teaching hospital. *Clin Endocrinol* 2002;56:95-101.
 83. Lemos LB, Baliga M, Guo M. Blastomycosis: the great pretender can also be an opportunist. Initial clinical diagnosis and underlying diseases in 123 patients. *Ann Diagn Pathol.* 2002;6:194–203.
 84. Xie J, Dai J, Zhou WL, et al. Adrenal ganglioneuroma: Features and outcomes of 42 cases in a Chinese population. *World J Surg.* 2018;42:2469-2475
 85. Lonergan GJ, Schwab CM, Suarez ES, Carlson CL. Neuroblastoma, ganglioneuroblastoma, and ganglioneuroma: radiologic-pathologic correlation. *Radiographics* 2002;22:911-934
 86. Guo YK, Yang ZG, Li Y, et al Uncommon adrenal masses: CT and MRI features with histopathologic correlation. *Eur J Radiol.* 2007;62:359-370.
 87. Santosh K, Das MK, Ayyanar P, et al. Laparoscopic excision of a large Adrenal ganglioneuroma masquerading as pheochromocytoma – a case report & review of literature. *Urol Case Rep.* 2020;33:101276.
 88. Pinarli FG, Danaci M, Tander B, et al Bilateral adrenal cystic neuroblastoma with superior vena cava syndrome and massive intracystic haemorrhage. *Pediatr Radiol.* 2004;34:746-749.
 89. Lonergan GJ, Schwab CM, Suarez ES, et al. Neuroblastoma, ganglioneuroblastoma, and ganglioneuroma: radiologic-pathologic correlation. *Radiographics* 2002;22(4):911-934.
 90. Scott DJ, Wallace WH, Hendry GM. With advances in medical imaging can the radiologist reliably diagnose Wilms' tumours? *Clin Radiol* 1999;54:321327.
 91. Monclair T, Brodeur GM, Ambros PF, et al. INRG Task Force. The International Neuroblastoma Risk Group (INRG) staging system: An INRG Task Force report. *J Clin Oncol* 2009;27:298303.
 92. Bolzacchini E, Martinelli B, Pinotti G. Adult onset of ganglioneuroblastoma of the adrenal gland: case report and review of the literature. *Surgical Case Rep* 2015;11:79.
 93. Swift CC, Eklund MJ, Kraveka JM, et al. Updates in diagnosis, management, and treatment of neuroblastoma. *Radiographics* 2018;38:566–580.
 94. Brisse HJ, McCarville MB, Granata C. Guidelines for

- Imaging and Staging of Neuroblastic Tumors: Consensus Report from the international neuroblastoma Risk Group Project. *Radiology* 2011;261(1):243–257.
95. Brisse HJ, McCarville MB, Granata C. Guidelines for Imaging and Staging of Neuroblastic Tumors: Consensus Report from the international neuroblastoma Risk Group Project. *Radiology* 2011;261(1):243–257.
96. Gahr N, Darge K, Hahn G, et al. Diffusion-weighted MRI for differentiation of neuroblastoma and ganglioneuroblastoma/ganglioneuroma. *Eur J Radiol* 2011;79(3):443-446.
97. Matthay KK, Shulkin B, Ladenstein R, et al. Criteria for evaluation of disease extent by (123)I-metiodobenzylguanidine scans in neuroblastoma: a report of the International Neuroblastoma Risk Group (INRG) Task Force. *Br J Cancer* 2010;102(9):1319–1326.
98. Crona J, Taieb D and Pacak K: New perspectives on pheochromocytoma and paraganglioma: Towards a molecular classification. *Endocr Rev* 2017;38:489–515.
99. Murphy JM, La Quaglia MP. Advances in the surgical treatment of neuroblastoma: a review. *Eur Pediatr Surg* 2014;24(6):450–456.
100. Mendiratta-Lala, M, Avram A, Turcu AF, et al. Adrenal Imaging. *Endocrinol. Metab. Clin. N. Am.* 2017;46:741–759.
101. Zelinka T, Musil Z, Dušková J, et al. Metastatic pheochromocytoma: clinical, genetic, and histopathologic characteristics. *Eur J Clin Invest.* 2011;41(10):1121-1128.
102. Witteles RM, Kaplan EL, Roizen MF. Sensitivity of Diagnostic and Localization Tests for Pheochromocytoma in Clinical Practice. *Arch. Intern. Med.* 2000;160:2521–2524.
103. Leung K, Stamm M, Raja A et al. Pheochromocytoma: the range of appearances on ultrasound, CT, MRI, and functional imaging. *Am J Roentgenol.* 2013;200(2):370-378.
104. Al Bunni F, Deganello A, Sellars ME, et al. Contrast-enhanced ultrasound (CEUS) appearances of an adrenal phaeochromocytoma in a child with Von Hippel-Lindau disease. *J Ultrasound.* 2014;17(4):307-311.
105. Lenders JW, Eisenhofer G, Mannelli M et al. Phaeochromocytoma. *Lancet* 2005;366: 665-675.
106. Nandra G, Duxbury O, Patel P, et al. Technical and Interpretive Pitfalls in Adrenal Imaging. *Radiographics*. 2020;40(4):1041-1060.
107. Tsushima Y, Takahashi-Taketomi A, Endo K. Diagnostic utility of diffusion-weighted MR imaging and apparent diffusion coefficient value for the diagnosis of adrenal tumors. *J Magn Reson Imaging.* 2009;29(1):112-117.
108. Dong Y and Liu Q: Differentiation of malignant from benign pheochromocytomas with diffusion-weighted and dynamic contrast-enhanced magnetic resonance at 3.0 T. *J Comput Assist Tomogr* 2012;36:361-366.
109. Kim S, Salibi N, Hardie AD, et al. Characterization of adrenal pheochromocytoma using respiratory-triggered proton MR spectroscopy:initial experience. *Am J Roentgenol.* 2009;192(2):450-454.
110. Ng L, Libertino JM: Adrenocortical carcinoma: diagnosis, evaluation and treatment. *J Urol* 2003;169:5–11.
111. Rowe SP, Javadi MS, Solnes LB, et al. Appearance of Adrenal Myelolipomas on 2-Deoxy-2-(18F) Fluoro-D-Glucose Positron Emission Tomography-Computed Tomography. *World J. Nucl. Med.* 2017;16:271–274.
112. Panda A, Das CJ, Dhamija E, et al. Adrenal Imaging (Part 1): Imaging Techniques and Primary Cortical Lesions. *Indian J. Endocrinol. Metab.* 2015;19:8–15.
113. Groussin L, Bonardel G, Silvera S, et al. 18F-fluorodeoxyglucose positron emission tomography for the diagnosis of adrenocortical tumors: a prospective study in 77 operated patients. *J Clin Endocrinol Metab* 2009;94:1713-1722.
114. Zhang LJ, Yang GF, Shen W, et al. Imaging of primary adrenal lymphoma: Case report and literature review. *Acta Radiol.* 2006;47:993–997.
115. Altaiar A, Aslan A, Gündüz N, et al. Unilateral Primary Adrenal B-Cell Lymphoma Clinically Mimicking Chronic Gastritis. *Polish Journal of Radiology.* 2017;82:612-615.
116. Lattin GE, Sturgill ED, Tujo CA, et al. From the radiologic pathology archives adrenal tumors and tumor-like conditions in the adult: radiologic-pathologic correlation. *RadioGraphics* 2014;34:805-829.
117. Anis M, Irshad A. Imaging of abdominal lymphoma. *Radiol Clin North Am* 2008;46:265-85.
118. Rashidi A, Fisher SI. Primary adrenal lymphoma: a systematic review. *Ann Hematol* 2013;92:1583-1593.
119. Cuce F. Adreniform Shape of Nonadenom Surrenal Lesion: Lymphoma. Cuce. *Int J Radiol Imaging Technol* 2019;5:43.
120. Rashidi A, Fisher SI. Primary adrenal lymphoma: A systematic review. *Ann Hematol* 2013;92:1583-1593.
121. Hussain HK, Korobkin M. MR imaging of the adrenal glands. *Magn Reson Imaging Clin N Am* 2004;12:515-544.
122. Paes FM, Kalkanis DG, Sideras PA, et al. FDG PET/CT of extranodal involvement in non-Hodgkin lymphoma and Hodgkin disease. *Radiographics* 2016;30:269-291.
123. Dushyant VS, Anthony ES. Abdominal Imaging. 2016, (2nd edn), Elsevier Health Sciences, 880-881.
124. Park SY, Park BK, Kim CK. The value of adding (18) F-FDG PET/CT to adrenal protocol CT for characterizing adrenal metastasis (≥ 10 mm) in oncologic patients. *Am J Roentgenol.* 2014;202(2):153-160.
125. Allen BC Francis, I.R. Adrenal Imaging and Intervention. *Radiol. Clin. North. Am.* 2015;53:1021–1035.
126. Schieda N, Siegelman ES. Update on CT and MRI of Adrenal Nodules. *Am. J. Roentgenol.* 2017;208:1206–1217.