

## CONCLUSIONS

- MRI can substitute CT in evaluation of pediatric pelvic masses for many reasons, maybe the most important of which is avoiding the health risk associated with ionizing radiation dose from a CT procedure, more importantly in children surviving cancer who need life-long serial assessments. In addition, MRI provides inherently superior anatomic details and soft tissue contrast.
- MRI is an efficient imaging method for differentiation of neoplastic from non neoplastic pelvic masses in children.
- MRI is an efficient imaging method that can be used for staging of neoplastic pelvic masses in children including local extension as well as metastatic lesions.
- MRI can provide data for some specific diagnoses as fat containing lesions, hemorrhagic lesions and different types of anatomical derangements of pediatric gynecological system.
- DWI is useful tool for differentiating between neoplastic and non neoplastic masses in pediatrics.

---

## REFERENCES

1. Pai DR, Ladino-Torres MF. Magnetic resonance imaging of pediatric pelvic masses. *Magn Reson Imaging Clin N Am*. 2013;21:751-72.
2. Siegel MJ, Hoffer FA. Magnetic resonance imaging of nongynecologic pelvic masses in children. *Magnetic resonance imaging clinics of North America*. [Review]. 2002;10:325-44, vi.
3. Shah RU, Lawrence C, Fickenscher KA, Shao L, Lowe LH. Imaging of pediatric pelvic neoplasms. *Radiol Clin North Am*. 2011;49:729-48, vi.
4. Hugosson C, Nyman R, Jacobsson B, Jorulf H, McDonald P, Sackey K. Imaging and compartmental classification of solid pelvic tumours in children. *Pediatr Radiol*. 1996;26:861-8.
5. Kocaoglu M, Frush DP. Pediatric presacral masses. *Radiographics : a review publication of the Radiological Society of North America, Inc*. [Review]. 2006;26:833-57.
6. Groff DB. Pelvic neoplasms in children. *Journal of surgical oncology*. [Review]. 2001;77:65-71.
7. Haddad MC, Birjawi GA, Hemadeh MS, Melhem RE, Al-Kutoubi AM. The gamut of abdominal and pelvic cystic masses in children. *Eur Radiol*. 2001;11:148-66.
8. Onur MR, Bakal U, Kocakoc E, Tartar T, Kazez A. Cystic abdominal masses in children: a pictorial essay. *Clinical imaging*. 2013;37:18-27.
9. Finelli A, Babyn P, Lorie GA, Bagli D, Khoury AE, Merguerian PA. The use of magnetic resonance imaging in the diagnosis and followup of pediatric pelvic rhabdomyosarcoma. *The Journal of urology*. [Case Reports]. 2000;163:1952-3.
10. Servaes S, Victoria T, Lovrenski J, Epelman M. Contemporary pediatric gynecologic imaging. *Seminars in ultrasound, CT, and MR*. [Review]. 2010;31:116-40.
11. Bullard Dunn K. Retrorectal tumors. *Surg Clin North Am*. 2010;90:163-71, Table of Contents.
12. Schultz KA, Sencer SF, Messinger Y, Neglia JP, Steiner ME. Pediatric ovarian tumors: a review of 67 cases. *Pediatr Blood Cancer*. 2005;44:167-73.
13. Shedid D, Roger EP, Benzel EC, editors. *Presacral meningocele: diagnosis and treatment*. *Seminars in Spine Surgery*; 2006: Elsevier.
14. Martucciello G, Torre M, Belloni E, Lerone M, Pini Prato A, Cama A, et al. Currarino syndrome: proposal of a diagnostic and therapeutic protocol. *J Pediatr Surg*. 2004;39:1305-11.
15. Jayarani K, Kumar G. It is not just constipation—duplication cyst and spinal anomaly. *European Journal of Radiology Extra*. 2007;64:35-8.

16. Siegel MJ. Magnetic resonance imaging of the adolescent female pelvis. *Magn Reson Imaging Clin N Am*. 2002;10:303-24, vi.
17. Garel L, Dubois J, Grignon A, Filiatrault D, Van Vliet G. US of the pediatric female pelvis: a clinical perspective. *Radiographics*. 2001;21:1393-407.
18. Hobson KG, Ghaemmaghami V, Roe JP, Goodnight JE, Khatri VP. Tumors of the retrorectal space. *Diseases of the colon & rectum*. 2005;48:1964-74.
19. Nour-Eldin NE, Abdelmonem O, Tawfik AM, Naguib NN, Klingebiel T, Rolle U, et al. Pediatric primary and metastatic neuroblastoma: MRI findings: pictorial review. *Magn Reson Imaging*. 2012;30:893-906.
20. Brisse HJ, McCarville MB, Granata C, Krug KB, Wootton-Gorges SL, Kanegawa K, et al. Guidelines for Imaging and Staging of Neuroblastic Tumors: Consensus Report from the International Neuroblastoma Risk Group Project. *Radiology*. 2011;261:243-57.
21. Brody AS, Frush DP, Huda W, Brent RL. Radiation risk to children from computed tomography. *Pediatrics*. 2007;120:677-82.
22. Hoffer FA. Magnetic resonance imaging of abdominal masses in the pediatric patient. *Semin Ultrasound CT MR*. 2005;26:212-23.
23. Kwee TC, Takahara T, Vermoolen MA, Bierings MB, Mali WP, Nievelstein RA. Whole-body diffusion-weighted imaging for staging malignant lymphoma in children. *Pediatr Radiol*. 2010;40:1592-602; quiz 720-1.
24. Brenner DJ, Hall EJ. Computed tomography--an increasing source of radiation exposure. *N Engl J Med*. 2007;357:2277-84.
25. Carty HM. Paediatric emergencies: non-traumatic abdominal emergencies. *Eur Radiol*. 2002;12:2835-48.
26. Shah NB, Platt SL. ALARA: is there a cause for alarm? Reducing radiation risks from computed tomography scanning in children. *Curr Opin Pediatr*. 2008;20:243-7.
27. Chavhan GB, Babyn PS, Vasanawala SS. Abdominal MR imaging in children: motion compensation, sequence optimization, and protocol organization. *Radiographics*. 2013;33:703-19.
28. Hassan I, Wietfeldt ED. Presacral tumors: diagnosis and management. *Clin Colon Rectal Surg*. 2009;22:84-93.
29. Lev-Chelouche D, Gutman M, Goldman G, Even-Sapir E, Meller I, Issakov J, et al. Presacral tumors: a practical classification and treatment of a unique and heterogeneous group of diseases. *Surgery*. 2003;133:473-8.
30. Bartels SA, van Koperen PJ, van der Steeg AF, Deurloo EE, Bemelman WA, Heij HA. Presacral masses in children: presentation, aetiology and risk of malignancy. *Colorectal Dis*. 2011;13:930-4.

31. Hayes-Jordan A, Andrassy R. Rhabdomyosarcoma in children. *Curr Opin Pediatr.* 2009;21:373-8.
32. Kaefer M, Rink RC. Genitourinary rhabdomyosarcoma: treatment options. *Urologic Clinics of North America.* 2000;27:471-87.
33. Agrons GA, Wagner BJ, Lonergan GJ, Dickey GE, Kaufman MS. From the archives of the AFIP. Genitourinary rhabdomyosarcoma in children: radiologic-pathologic correlation. *Radiographics.* 1997;17:919-37.
34. Nguyen MM, Katzberg RW, Wootton-Gorges SL, Das S. Computed tomography and magnetic resonance imaging in paediatric urology. *BJU Int.* 2006;98:273-7.
35. Huppmann AR, Pawel BR. Polyps and masses of the pediatric urinary bladder: a 21-year pathology review. *Pediatric and Developmental Pathology.* 2011;14:438-44.
36. Wong-You-Cheong JJ, Woodward PJ, Manning MA, Sesterhenn IA. Neoplasms of the Urinary Bladder: Radiologic-Pathologic Correlation1. *Radiographics.* 2006;26:553-80.
37. Zacharia TT, Jaramillo D, Poussaint TY, Korf B. MR imaging of abdominopelvic involvement in neurofibromatosis type 1: a review of 43 patients. *Pediatric radiology.* 2005;35:317-22.
38. Castellino SM, McLean TW. Pediatric genitourinary tumors. *Current opinion in oncology.* 2007;19:248-53.
39. Berrocal T, Lopez-Pereira P, Arjonilla A, Gutierrez J. Anomalies of the distal ureter, bladder, and urethra in children: embryologic, radiologic, and pathologic features. *Radiographics.* 2002;22:1139-64.
40. Dehner LP, Jarzembowski JA, Hill DA. Embryonal rhabdomyosarcoma of the uterine cervix: a report of 14 cases and a discussion of its unusual clinicopathological associations. *Mod Pathol.* 2012;25:602-14.
41. Hanprasertpong J, Chandeying V. Gynecologic tumors during childhood and adolescence. *J Med Assoc Thai.* 2006;89:S192-8.
42. Junqueira BL, Allen LM, Spitzer RF, Lucco KL, Babyn PS, Doria AS. Mullerian duct anomalies and mimics in children and adolescents: correlative intraoperative assessment with clinical imaging. *Radiographics.* 2009;29:1085-103.
43. Behr SC, Courtier JL, Qayyum A. Imaging of mullerian duct anomalies. *Radiographics.* 2012;32:E233-50.
44. Huisman TA, van der Hoef M, Willi UV, Gobet R, Lebowitz RL. Pre-and postnatal imaging of a girl with a cloacal variant. *Pediatric radiology.* 2006;36:991-6.
45. Hayashi S, Sago H, Kashima K, Kitano Y, Kuroda T, Honna T, et al. Prenatal diagnosis of fetal hydrometrocolpos secondary to a cloacal anomaly by magnetic resonance imaging. *Ultrasound in obstetrics & gynecology.* 2005;26:577-9.

46. Jaramillo D, Lebowitz R, Hendren W. The cloacal malformation: radiologic findings and imaging recommendations. *Radiology*. 1990;177:441-8.
47. Mohammad SA, AbouZeid AA. MRI of persistent cloaca: Can it substitute conventional imaging? *European journal of radiology*. 2013;82:241-51.
48. Orazi C, Lucchetti MC, Schingo PM, Marchetti P, Ferro F. Herlyn-Werner-Wunderlich syndrome: uterus didelphys, blind hemivagina and ipsilateral renal agenesis. Sonographic and MR findings in 11 cases. *Pediatric radiology*. 2007;37:657-65.
49. Troiano RN, McCarthy SM. Mullerian duct anomalies: imaging and clinical issues. *RADIOLOGY-OAK BROOK IL*-. 2004;233:19-34.
50. Ballesio L, Andreoli C, De Cicco M, Angeli M, Manganaro L. Hematocolpos in double vagina associated with uterus didelphys: US and MR findings. *European journal of radiology*. 2003;45:150-3.
51. Marten K, Vosshenrich R, Funke M, Obenauer S, Baum F, Grabbe E. MRI in the evaluation of müllerian duct anomalies. *Clinical imaging*. 2003;27:346-50.
52. Capito C, Echaieb A, Lortat-Jacob S, Thibaud E, Sarnacki S, Nihoul-Fekete C. Pitfalls in the diagnosis and management of obstructive uterovaginal duplication: a series of 32 cases. *Pediatrics*. 2008;122:e891-7.
53. Kapsalaki E, Daponte A, Deligeoroglou E, Zavos A, Fezoulidis I, Messinis IE. The role of MRI in young adolescent girls with hematocolpos. *European Journal of Radiology Extra*. 2011;78:e97-e100.
54. Cass DL, Hawkins E, Brandt ML, Chintagumpala M, Bloss RS, Milewicz AL, et al. Surgery for ovarian masses in infants, children, and adolescents: 102 consecutive patients treated in a 15-year period. *Journal of pediatric surgery*. 2001;36:693-9.
55. Schultz KA, Ness KK, Nagarajan R, Steiner ME. Adnexal masses in infancy and childhood. *Clin Obstet Gynecol*. 2006;49:464-79.
56. Tsakiri SP, Turk CA, Lally KP, Garg K, Morris B. Atypical Meigs' syndrome in a neonate with ovarian torsion associated with an ovarian dermoid cyst. *Pediatr Surg Int*. 2005;21:407-9.
57. Templeman CL, Fallat ME. Benign ovarian masses. *Semin Pediatr Surg*. 2005;14:93-9.
58. Timmerman D, Testa A, Bourne T, Ameye L, Jurkovic D, Van Holsbeke C, et al. Simple ultrasound-based rules for the diagnosis of ovarian cancer. *Ultrasound in obstetrics & gynecology*. 2008;31:681-90.
59. Brammer H, Buck J, Hayes W, Sheth S, Tavassoli F. From the archives of the AFIP. Malignant germ cell tumors of the ovary: radiologic-pathologic correlation. *Radiographics*. 1990;10:715-24.

60. Ghossain M, Buy J, Lignerès C, Bazot M, Hassen K, Malbec L, et al. Epithelial tumors of the ovary: comparison of MR and CT findings. *Radiology*. 1991;181:863-70.
61. Outwater EK, Siegelman ES, Hunt JL. Ovarian teratomas: tumor types and imaging characteristics. *Radiographics*. 2001;21:475-90.
62. Peterson CM, Buckley C, Holley S, Menias CO. Teratomas: a multimodality review. *Current problems in diagnostic radiology*. [Review]. 2012;41:210-9.
63. Heifetz SA, Cushing B, Giller R, Shuster JJ, Stolar CJ, Vinocur CD, et al. Immature teratomas in children: pathologic considerations: a report from the combined Pediatric Oncology Group/Children's Cancer Group. *The American journal of surgical pathology*. 1998;22:1115-24.
64. Jung SE, Lee JM, Rha SE, Byun JY, Jung JI, Hahn ST. CT and MR Imaging of Ovarian Tumors with Emphasis on Differential Diagnosis 1. *Radiographics*. 2002;22:1305-25.
65. Anthony EY, Caserta MP, Singh J, Chen MY. Adnexal masses in female pediatric patients. *AJR Am J Roentgenol*. 2012;198:W426-31.
66. De Backer A, Madern GC, Oosterhuis JW, Hakvoort-Cammel FG, Hazebroek FW. Ovarian germ cell tumors in children: a clinical study of 66 patients. *Pediatric blood & cancer*. 2006;46:459-64.
67. Jung SE, Rha SE, Lee JM, Park SY, Oh SN, Cho KS, et al. CT and MRI findings of sex cord-stromal tumor of the ovary. *American journal of Roentgenology*. 2005;185:207-15.
68. Azuma A, Koyama T, Mikami Y, Tamai K, Fujimoto K, Morisawa N, et al. A case of Sertoli-Leydig cell tumour of the ovary with a multilocular cystic appearance on CT and MR imaging. *Pediatr Radiol*. 2008;38:898-901.
69. Epelman M, Chikwava KR, Chauvin N, Servaes S. Imaging of pediatric ovarian neoplasms. *Pediatric radiology*. 2011;41:1085-99.
70. McCarville MB, Hill DA, Miller BE, Pratt CB. Secondary ovarian neoplasms in children: imaging features with histopathologic correlation. *Pediatric Radiology*. 2001;31:358-64.
71. Strickland JL. Ovarian cysts in neonates, children and adolescents. *Curr Opin Obstet Gynecol*. 2002;14:459-65.
72. Chang HC, Bhatt S, Dogra VS. Pearls and Pitfalls in Diagnosis of Ovarian Torsion1. *Radiographics*. 2008;28:1355-68.
73. Albayram F, Hamper UM. Ovarian and adnexal torsion: spectrum of sonographic findings with pathologic correlation. *Journal of ultrasound in medicine*. 2001;20:1083-9.

74. Lee EJ, Kwon HC, Joo HJ, Suh JH, Fleischer AC. Diagnosis of ovarian torsion with color Doppler sonography: depiction of twisted vascular pedicle. *Journal of ultrasound in medicine*. 1998;17:83-9.
75. Vijayaraghavan SB. Sonographic whirlpool sign in ovarian torsion. *Journal of ultrasound in medicine*. 2004;23:1643-9.
76. Duigenan S, Oliva E, Lee SI. Ovarian torsion: diagnostic features on CT and MRI with pathologic correlation. *American journal of Roentgenology*. 2012;198:W122-W31.
77. Rha SE, Byun JY, Jung SE, Jung JI, Choi BG, Kim BS, et al. CT and MR Imaging Features of Adnexal Torsion1. *Radiographics*. 2002;22:283-94.
78. Breech LL, Hillard PJ. Adnexal torsion in pediatric and adolescent girls. *Curr Opin Obstet Gynecol*. 2005;17:483-9.
79. Harmon JC, Binkovitz LA, Binkovitz LE. Isolated fallopian tube torsion: sonographic and CT features. *Pediatr Radiol*. 2008;38:175-9.
80. Pampal A, Atac GK, Nazli ZS, Ozen IO, Sipahi T. A rare cause of acute abdominal pain in adolescence: hydrosalpinx leading to isolated torsion of fallopian tube. *J Pediatr Surg*. 2012;47:e31-4.
81. Hartmann KA, Lerand SJ, Jay MS. Tubo-ovarian abscess in virginal adolescents: exposure of the underlying etiology. *J Pediatr Adolesc Gynecol*. 2009;22:e13-6.
82. Roche O, Chavan N, Aquilina J, Rockall A. Radiological appearances of gynaecological emergencies. *Insights Imaging*. 2012;3:265-75.
83. Canelles E, Roig JV, Cantos M, Garcia Armengol J, Barreiro E, Villalba FL, et al. [Presacral tumors. Analysis of 20 surgically treated patients]. *Cir Esp*. 2009;85:371-7.
84. Hain KS, Pickhardt PJ, Lubner MG, Menias CO, Bhalla S. Presacral masses: multimodality imaging of a multidisciplinary space. *Radiographics*. 2013;33:1145-67.
85. Lakhoo K. Neonatal teratomas. *Early Hum Dev*. 2010;86:643-7.
86. Altman RP, Randolph JG, Lilly JR. Sacrococcygeal teratoma: American Academy of Pediatrics Surgical Section Survey-1973. *J Pediatr Surg*. 1974;9:389-98.
87. Rescorla FJ. Pediatric germ cell tumors. *Semin Pediatr Surg*. 2012;21:51-60.
88. Gabra HO, Jesudason EC, McDowell HP, Pizer BL, Losty PD. Sacrococcygeal teratoma--a 25-year experience in a UK regional center. *J Pediatr Surg*. 2006;41:1513-6.
89. Barksdale Jr EM, Obokhare I. Teratomas in infants and children. *Current opinion in pediatrics*. 2009;21:344-9.

90. Keslar PJ, Buck JL, Suarez ES. Germ cell tumors of the sacrococcygeal region: radiologic-pathologic correlation. *Radiographics*. 1994;14:607-20; quiz 21-2.
91. Siegel MJ, Jaju A. MR imaging of neuroblastic masses. *Magn Reson Imaging Clin N Am*. 2008;16:499-513, vi.
92. Wells RG, Sty JR. Imaging of sacrococcygeal germ cell tumors. *Radiographics*. 1990;10:701-13.
93. Ueno T, Tanaka YO, Nagata M, Tsunoda H, Anno I, Ishikawa S, et al. Spectrum of Germ Cell Tumors: From Head to Toe1. *Radiographics*. 2004;24:387-404.
94. Diel J, Ortiz O, Losada RA, Price DB, Hayt MW, Katz DS. The Sacrum: Pathologic Spectrum, Multimodality Imaging, and Subspecialty Approach1. *Radiographics*. 2001;21:83-104.
95. Narula MK, Gupta N, Anand R, Kapoor S. Extrasosseous Ewing's sarcoma / primitive neuroectodermal tumor of the sacral nerve plexus. *Indian J Radiol Imaging*. 2009;19:151-4.
96. Llauger J, Palmer J, Amores S, Bague S, Camins A. Primary tumors of the sacrum: diagnostic imaging. *American journal of Roentgenology*. 2000;174:417-24.
97. Hiorns MP, Owens CM. Radiology of neuroblastoma in children. *Eur Radiol*. 2001;11:2071-81.
98. Berdon WE, Stylianos S, Ruzal-Shapiro C, Hoffer F, Cohen M. Neuroblastoma arising from the organ of Zuckerkandl: an unusual site with a favorable biologic outcome. *Pediatric Radiology*. 1999;29:497-502.
99. Hildebrandt T, Traunecker H. Neuroblastoma: A tumour with many faces. *Current Paediatrics*. 2005;15:412-20.
100. Meyer JS, Harty MP, Khademian Z. Imaging of neuroblastoma and Wilms' tumor. *Magn Reson Imaging Clin N Am*. 2002;10:275-302.
101. Kushner BH. Neuroblastoma: a disease requiring a multitude of imaging studies. *J Nucl Med*. 2004;45:1172-88.
102. Goo HW, Choi SH, Ghim T, Moon HN, Seo JJ. Whole-body MRI of paediatric malignant tumours: comparison with conventional oncological imaging methods. *Pediatr Radiol*. 2005;35:766-73.
103. Mazumdar A, Siegel MJ, Narra V, Luchtman-Jones L. Whole-body fast inversion recovery MR imaging of small cell neoplasms in pediatric patients: a pilot study. *American journal of Roentgenology*. 2002;179:1261-6.
104. Arazi-Kleinmann T, Mor Y, Brand N, Gayer G. Neurofibromatosis diagnosed on CT with MR correlation. *Eur J Radiol*. 2002;42:69-73.

105. Nishie A, Yoshimitsu K, Honda H, Irie H, Aibe H, Shinozaki K, et al. Presacral dermoid cyst with scanty fat component: usefulness of chemical shift and diffusion-weighted MR imaging. *Comput Med Imaging Graph*. 2003;27:293-6.
106. Yang DM, Kim HC, Lee HL, Lee SH, Kim GY. Squamous cell carcinoma arising from a presacral epidermoid cyst: CT and MR findings. *Abdom Imaging*. 2008;33:498-500.
107. Gross E, Koplewitz BZ, Arbell D, Fellig J, Udassin R. Ectopic presacral choroid plexus cyst in a neonate. *J Pediatr Surg*. 2009;44:e13-5.
108. Watanabe M, Komuro H, Kaneko M, Hori T, Tatekawa Y, Kudo S, et al. A rare case of presacral cystic neuroblastoma in an infant. *Journal of pediatric surgery*. 2008;43:1376-9.
109. Kim AY, Yoo SY, Kim JH, Eo H, Jeon TY. Currarino syndrome: variable imaging features in three siblings with HLXB9 gene mutation. *Clin Imaging*. 2013;37:398-402.
110. Konen O, Rathaus V, Dlugy E, Freud E, Kessler A, Shapiro M, et al. Childhood abdominal cystic lymphangioma. *Pediatr Radiol*. 2002;32:88-94.
111. Stein-Wexler R. MR imaging of soft tissue masses in children. *Magn Reson Imaging Clin N Am*. 2009;17:489-507, vi.
112. Toma P, Granata C, Rossi A, Garaventa A. Multimodality Imaging of Hodgkin Disease and Non-Hodgkin Lymphomas in Children1. *Radiographics*. 2007;27:1335-54.
113. Biko DM, Anupindi SA, Hernandez A, Kersun L, Bellah R. Childhood Burkitt lymphoma: abdominal and pelvic imaging findings. *AJR Am J Roentgenol*. 2009;192:1304-15.
114. Crawshaw J, Sohaib SA, Wotherspoon A, Shepherd JH. Primary non-Hodgkin's lymphoma of the ovaries: imaging findings. *Br J Radiol*. 2007;80:e155-8.
115. Jamieson DH, Shipman PJ, Israel DM, Jacobson K. Comparison of multidetector CT and barium studies of the small bowel: inflammatory bowel disease in children. *American journal of Roentgenology*. 2003;180:1211-6.
116. Nitta N, Takahashi M, Furukawa A, Murata K, Mori M, Fukushima M. MR imaging of the normal appendix and acute appendicitis. *Journal of Magnetic Resonance Imaging*. 2005;21:156-65.
117. McGuinness B, Wilson N, Doyle A. The "penumbra sign" on T1-weighted MRI for differentiating musculoskeletal infection from tumour. *Skeletal radiology*. 2007;36:417-21.
118. Essary B, Kim J, Anupindi S, Katz JA, Nimkin K. Pelvic MRI in children with Crohn disease and suspected perianal involvement. *Pediatr Radiol*. 2007;37:201-8.

119. Dubois J, Alison M. Vascular anomalies: what a radiologist needs to know. *Pediatric radiology*. 2010;40:895-905.
120. Konez O, Burrows P. Magnetic resonance of vascular anomalies. *Magnetic resonance imaging clinics of North America*. 2002;10:363.
121. Teo E-LH, Strouse PJ, Hernandez RJ. MR imaging differentiation of soft-tissue hemangiomas from malignant soft-tissue masses. *American journal of Roentgenology*. 2000;174:1623-8.
122. Zhang W-d, Li C-x, Liu Q-y, Hu Y-y, Cao Y, Huang J-h. CT, MRI, and FDG-PET/CT imaging findings of abdominopelvic desmoplastic small round cell tumors: Correlation with histopathologic findings. *European journal of radiology*. 2011;80:269-73.
123. Bellah R, Suzuki-Bordalo L, Brecher E, Ginsberg JP, Maris J, Pawel BR. Desmoplastic small round cell tumor in the abdomen and pelvis: report of CT findings in 11 affected children and young adults. *American journal of Roentgenology*. 2005;184:1910-4.
124. Chouli M, Viala J, Dromain C, Fizazi K, Duvillard P, Vanel D. Intra-abdominal desmoplastic small round cell tumors: CT findings and clinicopathological correlations in 13 cases. *European journal of radiology*. 2005;54:438-42.
125. Tateishi U, Hasegawa T, Kusumoto M, Oyama T, Ishikawa H, Moriyama N. Desmoplastic small round cell tumor: imaging findings associated with clinicopathologic features. *Journal of computer assisted tomography*. 2002;26:579-83.
126. Riebel T, Maurer J, Teichgraber UK, Bassir C. The spectrum of imaging in Currarino triad. *Eur Radiol*. 1999;9:1348-53.
127. Sekaran P, Brindley N. A case of Currarino's syndrome presenting as neonatal bowel obstruction. *J Pediatr Surg*. 2012;47:1600-3.
128. Maudgil DD, McHugh K. The role of computed tomography in modern paediatric urology. *European journal of radiology*. [Review]. 2002;43:129-38.
129. Semelka RC, Armao DM, Elias J, Huda W. Imaging strategies to reduce the risk of radiation in CT studies, including selective substitution with MRI. *Journal of Magnetic Resonance Imaging*. 2007;25:900-9.
130. Vazquez E, Castellote A, Piqueras J, Ortuno P, Sanchez-Toledo J, Nogues P, et al. Second malignancies in pediatric patients: imaging findings and differential diagnosis. *Radiographics*. 2003;23:1155-72.
131. Smith EA. Advanced techniques in pediatric abdominopelvic oncologic magnetic resonance imaging. *Magn Reson Imaging Clin N Am*. 2013;21:829-41.
132. MacKenzie JD, Vasanawala SS. Advances in pediatric MR imaging. *Magn Reson Imaging Clin N Am*. 2008;16:385-402, v.

133. Anupindi S, Jaramillo D. Pediatric magnetic resonance imaging techniques. *Magn Reson Imaging Clin N Am*. 2002;10:189-207.
134. Darge K, Anupindi SA, Jaramillo D. MR imaging of the abdomen and pelvis in infants, children, and adolescents. *Radiology*. 2011;261:12-29.
135. McDonald K, Sebire NJ, Anderson J, Olsen ØE. Patterns of shift in ADC distributions in abdominal tumours during chemotherapy—feasibility study. *Pediatric radiology*. 2011;41:99-106.
136. Rha SE, Byun JY, Jung SE, Kim HL, Oh SN, Kim H, et al. Atypical CT and MRI manifestations of mature ovarian cystic teratomas. *American journal of Roentgenology*. 2004;183:743-50.
137. Kawakami S, Togash K, Egawa H, Kimura I, Fukuoka M, Mori T, et al. Solid mature teratoma of the ovary: appearances at MR imaging. *Computerized medical imaging and graphics*. 1994;18:203-7.
138. Wisniewski M, Deppisch LM. Solid teratomas of the ovary. *Cancer*. 1973;32:440-6.
139. Shafie ME, Furay RW, Chablani L. Ovarian teratoma with peritoneal and lymph node metastases of mature glial tissue: a benign condition. *Journal of surgical oncology*. 1984;27:18-22.
140. Nanda S, Kalra B, Arora B, Singh S. Massive mature solid teratoma of the ovary with gliomatosis peritonei. *Australian and New Zealand journal of obstetrics and gynaecology*. 1998;38:329-31.
141. Müller AM, Söndgen D, Strunz R, Müller K-M. Gliomatosis peritonei: a report of two cases and review of the literature. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2002;100:213-22.
142. Scherer A, Niehues T, Engelbrecht V, Modder U. Imaging diagnosis of retroperitoneal ganglioneuroma in childhood. *Pediatr Radiol*. 2001;31:106-10.
143. Lonergan GJ, Schwab CM, Suarez ES, Carlson CL. Neuroblastoma, ganglioneuroblastoma, and ganglioneuroma: radiologic-pathologic correlation. *Radiographics*. 2002;22:911-34.
144. Van Rijn RR, Wilde JC, Bras J, Oldenburger F, McHugh KM, Merks JH. Imaging findings in noncraniofacial childhood rhabdomyosarcoma. *Pediatr Radiol*. 2008;38:617-34.
145. Dällenbach P, Bonnefoi H, Pelte M-F, Vlastos G. Yolk sac tumours of the ovary: an update. *European Journal of Surgical Oncology (EJSO)*. 2006;32:1063-75.
146. Fletcher CDM, Dal Cin P, de Wever I, Mandahl N, Mertens F, Mitelman F, et al. Correlation between Clinicopathological Features and Karyotype in Spindle Cell Sarcomas: A Report of 130 Cases from the CHAMP Study Group. *The American Journal of Pathology*. 1999;154:1841-7.

147. van Vliet M, Kliffen M, Krestin GP, van Dijke CF. Soft tissue sarcomas at a glance: clinical, histological, and MR imaging features of malignant extremity soft tissue tumors. *Eur Radiol.* 2009;19:1499-511.
148. Ferrozzi F, Catanese C, Uccelli M, Bassi P. [Ovarian lymphoma. Findings with ultrasonography, computerized tomography and magnetic resonance]. *Radiol Med.* 1998;95:493-7.
149. Mitsumori A, Joja I, Hiraki Y. MR appearance of non-Hodgkin's lymphoma of the ovary. *AJR Am J Roentgenol.* 1999;173:245.
150. Okada M, Sato N, Ishii K, Matsumura K, Hosono M, Murakami T. FDG PET/CT versus CT, MR imaging, and <sup>67</sup>Ga scintigraphy in the posttherapy evaluation of malignant lymphoma. *Radiographics.* 2010;30:939-57.
151. Dane C, Dane B, Erginbas M, Cetin A. Imperforate Hymen—A Rare Cause of Abdominal Pain: Two Cases and Review of the Literature. *Journal of Pediatric and Adolescent Gynecology.* 2007;20:245-7.
152. Mandava A, Prabhakar RR, Smitha S. OHVIRA Syndrome (obstructed hemivagina and ipsilateral renal anomaly) with Uterus Didelphys, an Unusual Presentation. *Journal of Pediatric and Adolescent Gynecology.* 2012;25:e23-e5.
153. Kang BK, Na DG, Ryoo JW, Byun HS, Roh HG, Pyeun YS. Diffusion-weighted MR imaging of intracerebral hemorrhage. *Korean J Radiol.* 2001;2:183-91.
154. Wasnik AP, Mazza MB, Liu PS. Normal and variant pelvic anatomy on MRI. *Magn Reson Imaging Clin N Am.* 2011;19:547-66; viii.

## الملخص العربي

أجريت هذه الدراسة على ٢٠ طفلاً لديهم كتلة حوضية تم تشخيصها أو مشتبه في وجودها اكلينيكيًا بهدف تقييم دور التصوير بأشعة الرنين المغناطيسي في تقييم وتشخيص هذه الكتل.

وتعرض جميع المرضى لأخذ كامل التاريخ المرضي (من الآباء والأمهات و الطبيب المعالج)، والفحص السريري الشامل واستعراض الفحوص المختبرية والأشعة السابقة المتاحة. وقد استخدم التخدير في المرضى غير المتعاونين (أقل من ٧ سنوات من العمر). وقد أجريت الدراسة باستخدام جهاز رنين مغناطيسي مغلق (بقوة مغناطيس 1.5 تسلا) و مزيج من عدة أنواع من متواليات الرنين المغناطيسي في اتجاهات مختلفة تم استخدام صبغة بالوريد في معظم الحالات

وشملت الدراسة ٥ ذكور و ١٥ إناث وتراوحت أعمارهم بين ٢ و ١٧ سنة. وتضمنت الكتل الحوضية التي تم فحصها ١٢ كتلة ورمية و ٨ كتل غير ورمية من أنواع مختلفة

الحالات الورمية شملت اثنين من المصابين بأورام حميدة (ورم مسخي ناضج بالمبيض وورم عصبي عقدي أمام العجز) و ١٠ من الأورام الخبيثة (العضلية المخططة بالبروستاتا، العضلية المخططة بعنق الرحم، ٤ حالات من ورم الكيس المحي، ساركوما الخلايا المغزلية، ورم حبلي أمام العجز، ورم بالغدد الليمفاوية، ورم عصبي). شملت الكتل الغير ورمية: (كيس جلداني أمام العجز، ورم ليمفاوي، كيس معقد بالمبيض، التواء بالمبيض مع نخر ثانوي وأربع حالات من تجمع دم الطمث بالمهبل و /أو تجويف الرحم)

تم إثبات أن أشعة الرنين المغناطيسي مفيدة جدا في تصوير التفاصيل التشريحية للكتل التي تم فحصها مع توضيح ممتاز لتباين الأنسجة و الوصف الدقيق لمكان و انتشار الكتل بالإضافة إلى القدرة على تمييز أنواع معينة من الأنسجة مثل الدهون والمحتويات النزفية. كانت المواصفات التصويرية مميزة جدا لبعض التشخيصات مثل أنواع الكتل غير الورمية و حالة الورم المسخي الناضج بالمبيض. وعلى النقيض أدت المواصفات الغير معتادة لورم مسخي بالمبيض في هيئة كتلة صلبة جنباً إلى جنب مع استسقاء وعقد بريتنونية للانطباع الخاطيء بكونها ورم غير ناضج و قد تم استبعاد هذا التشخيص بالتحليل الباثولوجي للعينات. كان التصوير بالرنين المغناطيسي أيضا ممتاز في بيان سبب عرقلة الدم و التشوهات الخلقية في حالات تجمع دم الطمث بالمهبل و /أو تجويف الرحم

وحتى في الحالات الورمية حيث كانت مميزات التصوير بالرنين المغناطيسي ليست محددة بما يكفي لتشخيص معين، كانت مفيدة للغاية لتأكيد التشخيص المبدأى لوجود ورم، توقع طبيعته إما حميدة أو خبيثة/عدوانية، و للوصف الدقيق لانتشار الورم. و هذه المعلومات كانت ضرورية للاستئصال الجراحي أو تحديد خط الأساس لمتابعة المريض بعد العلاج بالمواد الجديدة المساعدة.

# دور أشعة الرنين المغناطيسي فى تشخيص الأورام فى منطقة الحوض فى الأطفال

رسالة علمية

مقدمة لكلية الطب-جامعة الإسكندرية

إيفاءً جزئياً لشروط الحصول على درجة

الماجستير

فى

الأشعة التشخيصية والتدخلية

من

باسنت حسن شعبان

بكالوريوس الطب و الجراحة

كلية الطب

جامعة الإسكندرية

# دور أشعة الرنين المغناطيسي في تشخيص الأورام في منطقة الحوض في الأطفال

مقدمة من

باسنت حسن شعبان

للحصول على درجة

الماجستير في

الأشعة التشخيصية والتدخلية

موافقون

.....

لجنة المناقشة والحكم على الرسالة

أ.د/ أشرف نجيب عتابي  
أستاذ الأشعة التشخيصية  
كلية الطب  
جامعة الإسكندرية

.....

أ.د/ طارق يوسف عارف  
أستاذ الأشعة التشخيصية  
معهد البحوث الطبية  
جامعة الإسكندرية

.....

أ.د/ خالد محمد مغازى  
أستاذ الأشعة التشخيصية  
كلية الطب  
جامعة الإسكندرية

## المشرفون

.....  
أ.د/ أشرف نجيب عتابي  
أستاذ الأشعة التشخيصية  
كلية الطب  
جامعة الإسكندرية

## المشرفون المشاركون

.....  
د/ أحمد محمد سعيد أبو جبل  
أستاذ مساعد الأشعة التشخيصية  
كلية الطب  
جامعة الإسكندرية

.....  
د/ شادى حسن فاضل  
مدرس علاج الأورام و الطب النووى  
كلية الطب  
جامعة الإسكندرية

.....  
د/ دينا محمد عبد الله  
أستاذ مساعد علم الأمراض  
كلية الطب  
جامعة الإسكندرية