

## Kritik Pediatrik Travma Hastalarının Yönetimi

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### Erken Değerlendirme ve Travma Yönetimi

Travma pediatrik hasta popülasyonunda önemli bir morbidite ve mortalite nedenidir. Çocuk acile başvurularının %20 si travma sebebiyle olmaktadır. Pediatrik travmalarda mortalite ve morbidite yaralanma mekanizması ile yakından ilişkilidir (1,2).

### Yaralanma Şiddeti ve Epidemiyoloji

Uygulamada ve literatürde birçok yaralanma şiddeti ölçeği tanımlanmıştır. İlk yaygın olarak kullanılan ölçek, Kısaltılmış Yaralanma Ölçeği (Abbreviated Injury Scala, AIS) olup yaralanma şiddetinin anatomik ölçüsünü ifade eder. Fakat aynı vücut bölgesine bir-

den fazla yaralanma durumunda yaralanma şiddeti ve sağ kalımı belirlemede korelasyon sağlanamamaktadır. Yaralanma Şiddeti Skoru (Injury Severity Score, ISS), Yeni Yaralanma Şiddeti Skoru (NISS) ve Pediatrik Travma Skoru (Pediatric Trauma Score, (PTS)), Düzeltilmiş Travma Skoru diğer skorlamalara örnektir. Yaralanma Şiddeti Skoru (ISS) en ciddi yaralanmış üç bölgenin en yüksek AIS puanlarının karelerinin toplamıdır (tablo 3). Bu skorlamalarla ilgili tartışmalar mevcut olsa da PTS nin 8 in altında olması veya ISS'nin 10 'un üzerinde olması yaşamı tehdit eden yaralanmayı ifade eder (tablo 1-2-3) (3,4).

2015 yılında çocuklarda travma nedeniyle ölüm oranı 54.6/100.000 olarak saptanmıştır. Fakat nüfusa dayalı verilere bakıldığında ölümcül yaralanması olan hastaların %80'inin hastaneye başvurmadan önce hayatını kaybettiği görülmüştür. Bu durum, hastaneye

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değişken fonksiyonel ve kozmetik sonuçlarla tanımlanmıştır. Skrotal yaralanmalar penetran travma veya künt travma veya her ikisinden kaynaklanabilir. Ultrasonografi bu yaralanmaların değerlendirilmesinde faydalıdır (112,113).

## Kaza Dışı Travma (İhmal Ve İstismar)

Çocuk ihmal ve istismarı pediatrik travmaların %3-5'ini oluşturmakta olup çocuklarda önemli bir mortalite ve morbidite sebebidir. Açıklanamayan yaralanmalar, tedavi almadaki gecikme, olay tarihinin belirsiz olması ve fizik muayene bulgularıyla belirtilen tarihin uyumsuz olması, çocuğa bakan kişi diğer kardeşleri ve akrabaları suçluyorsa ya da çocuktan ziyade diğer yetişkinleri koruyorsa çocuk ihmal ve istismarından şüphelenilmelidir. Fizik muayenede beklenmedik lokalizasyonda kutanöz ekimozlar veya iyileşmekte olan iskelet fraktürleri, yürümeye başlamamış infantlarda uzun kemik diyafizlerinde fraktürler, olağandışı bölgelerde ve paternde yanıklar, alçak seviyeden düşme sonucu olduğu söylenen bilinç kayıpları olması ihmal ve istismar düşündürür (114). Sarsılmış Bebek Sendromu, bilinç bozukluğu, bilateral subdural hematoma, retinal hemoraji ile karakterize bir durum olup hastanın bir darbe alarak, isteyerek veya istenmeyerek sarsılmış olabileceğini düşündürür (115). İnfant döneminde görülen bu durum hipoksik iskemik ensefalopati ile sonuçlanabilmektedir. Bu olayların yönetiminde medikolegal yaklaşım esastır. Mutlaka adli rapor tutularak gerekli birimlere bildirilmesi gerekmektedir (116).

## Yanıklar

Pediatrik yanıkların %90'ı ev ortamında olmaktadır. İnfant ve okul çocuklarında genel-

likle sıcak su ve elektrik yanığı görülmekteyken alev yanıkları ise daha büyük çocuklarda görülmektedir. Erkeklerde kız çocuklarına göre daha sık görülmektedir. İnhalasyon yanıkları, vücut yüzey alanının %60'ından fazla olan yanıklar, 4 yaşın altındaki çocuklar, kaza dışı yanıklar, multiorgan yetmezlik, çoklu ilaç dirençli organizmaya bağlı sepsis durumlarında mortalite riskinin arttığı bildirilmiştir. Elektrik yanıkları rabdomiyoliz, böbrek yetmezliği, solunumsal ve kardiyak arrestle sonuçlanmaktadır (117).

İlk yaklaşımda ağrının kesilmesi, yanık bölgelerin ıslak gaz ile kapatılması aynı zamanda hastanın hipotermiden korunması esastır. Resüsitasyonun amacı dokularda perfüzyon ve oksijenlenmeyi maksimuma çıkarmaktır, bakteri kolonizasyonunu azaltmak ve dokuyu ekzizyon ve greftleme için hazırlamaktır. Yanık resüsitasyonunun temelleri, hava yolu yönetimi, total vücut yüzey alanının doğru hesaplanması, hemodinamik stabilizasyon, hastanın eşlik eden travma ve toksisite açısından değerlendirilmesidir. 2 yaşın altındaki ve total vücut yüzey alanının %20 sinden fazla yanığı olan hastalar ve inhalasyon yanıkları hava yolu açıklığı ve entübasyon açısından değerlendirilmelidir. Total vücut yüzey alanının (TVYA) %25'ini kaplayan yanıklarda sıvı resüsitasyonu başlanmalıdır. Saatlik idrar çıkışı en az 0.5-1 mL/kg/saat olmalıdır. 0-4 yaş arası çocuklarda özellikle ekstremitelerde yanıklarında ihmal ve istismar açısından dikkatli olunmalıdır (118).

## Kaynaklar

1. Richard J, Osmond MH, Nesbitt L, Stiell IG. Management and outcomes of pediatric patients transported by emergency medical services in a Canadian prehospital system. *Canadian Journal of Emergency Medicine*. 2006;8(1):6-12.
2. Haider AH, Crompton JG, Oyetunji T, Risucci D, Dirusso S, Basdag H, et al. Mechanism of injury predicts case fatality and functional outcomes in pediatric trauma patients: The case for its use in trauma outcomes studies. *Journal of Pediatric Surgery*. 2011;46(8):1557-63.

3. Tepas JP, Ramenofsky M. The Pediatric Trauma Score as a Predictor of Injury Severity: An Objective Assessment. *Journal of Trauma* . 1988;
4. Muisyo T, Bernardo EO, Camazine M, Colvin R, Thomas KA, Borgman MA, et al. Mortality prediction in pediatric trauma. *Journal of Pediatric Surgery (Internet)*. 2019;54(8):1613–6. Available from: <https://doi.org/10.1016/j.jpedsurg.2018.08.045>
5. Cooper A, Barlow B, Davidson L, Relethford J, O'Meara J, Mottley L. Epidemiology of pediatric trauma: Importance of population-based statistics. *Journal of Pediatric Surgery*. 1992;27(2):149–54.
6. Murphy SL, Xu J, Kochanek KD, Curtin SC, Arias E. Deaths: Final data for 2015. *National Vital Statistics Reports*. 2017;66(6).
7. Brown JK, Jing Y, Wang S, Ehrlich PF. Patterns of severe injury in pediatric car crash victims: Crash Injury Research Engineering Network database. *Journal of Pediatric Surgery*. 2006;41(2):362–7.
8. Sherman HE, Landry VL, Jones LM. Should Level I trauma centers be rated NC-17? *Journal of Trauma - Injury, Infection and Critical Care*. 2001;50(5):784–91.
9. Aaland O. M, Hlaing T. Pediatric Trauma Deaths: A Three-Part Analysis from a Nonacademic Trauma Center. *the american surgeon*. 2006;249–59.
10. Loiselle JM, Cone DC. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome: a controlled trial. *Annals of Emergency Medicine*. 2001;38(3):352–3.
11. Dressler AM, Finck CM, Carroll CL, Bonanni CC, Spinella PC. Use of a massive transfusion protocol with hemostatic resuscitation for severe intraoperative bleeding in a child. *Journal of Pediatric Surgery*. 2010;45(7):1530–3.
12. Eckert MJ, Wertin TM, Tyner SD, Nelson DW, Izenberg S, Martin MJ. Tranexamic acid administration to pediatric trauma patients in a combat setting: The pediatric trauma and tranexamic acid study (PED-TRAX). *Journal of Trauma and Acute Care Surgery*. 2014;77(6):852–8.
13. Evidence Statement: Major Trauma and the Use of Tranexamic Acid in Children November 2012. London: Royal College of Paediatrics and Child Health; 2012 [https://www.tarn.ac.uk/content/downloads/3100/121112\\_TXA%20evidence%20statement\\_final%20v2](https://www.tarn.ac.uk/content/downloads/3100/121112_TXA%20evidence%20statement_final%20v2) (Internet). Available from: [https://www.tarn.ac.uk/content/downloads/3100/121112\\_TXA\\_evidence\\_statement\\_final\\_v2](https://www.tarn.ac.uk/content/downloads/3100/121112_TXA_evidence_statement_final_v2)
14. Klinkner DB, Arca MJ, Lewis BD, Oldham KT, Sato TT. Pediatric vascular injuries: patterns of injury, morbidity, and mortality. *Journal of Pediatric Surgery*. 2007 Jan;42(1):178–83.
15. Keller MS, Coln CE, Trimble JA, Green MC, Weber TR. The utility of routine trauma laboratories in pediatric trauma resuscitations. *Am J Surg*. 2004;188(6):671–8.
16. Brody AS, Frush DP, Huda W, Brent RL, DiPietro MA, Applegate KE, et al. Radiation risk to children from computed tomography. *Pediatrics*. 2007 Sep;120(3):677–82.
17. Kuppermann N, Holmes JF, Dayan PS, Hoyle JD, Atabaki SM, Holubkov R, et al. Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *The Lancet*. 2009 Oct 9;374(9696):1160–70.
18. Wang MY, Griffith P, Sterling J, McComb JG, Levy ML. A prospective population-based study of pediatric trauma patients with mild alterations in consciousness (Glasgow Coma Scale score of 13-14). *Neurosurgery*. 2000;46(5):1093–9.
19. Masiakos PT, Pieretti-Vanmarcke R, Velmahos GC, Nance ML, Islam S, Falcone RA, et al. Clinical clearance of the cervical spine in blunt trauma patients younger than 3 years: A multi-center study of the american association for the surgery of trauma. *Journal of Trauma - Injury, Infection and Critical Care*. 2009;67(3):543–9.
20. Renton J, Kincaid S, Ehrlich PF. Should Helical CT Scanning of the Thoracic Cavity Replace the Conventional Chest X-ray as a Primary Assessment Tool in Pediatric Trauma? An Efficacy and Cost Analysis. 2003;
21. Holmes JF, Lillis K, Monroe D, Borgialli D, Kerrey BT, Mahajan P, et al. Identifying children at very low risk of clinically important blunt abdominal injuries. *Annals of Emergency Medicine*. 2013;62(2).
22. Pate1 JC, Tepas JJ, Jacksonville I. The Efficacy of Focused Abdominal Sonography for Trauma (FAST) as a Screening Tool in the Assessment of Injured Children. allen1998.
23. Peterson RJ, Tepas JJ, Edwards FH, Kissoon N, Pieper P, Ceithaml EL. Pediatric and adult thoracic trauma: Age-related impact on presentation and outcome. *The Annals of Thoracic Surgery*. 1994;58(1):14–8.
24. Woolsley CR, Mayes TC. The Pediatric Patient and Thoracic Trauma. *Seminars in Thoracic and Cardiovascular Surgery*. 2008 Mar;20(1):58–63.
25. Kessel B, Dagan J, Swaid F, Ashkenazi I, Olsha O, Peleg K, et al. Rib fractures: Comparison of associated injuries between pediatric and adult population. *American Journal of Surgery*. 2014 Nov 1;208(5):831–4.
26. Golden J, Isani M, Bowling J, Zagory J, Goodhue CJ, Burke R v., et al. Limiting chest computed tomography in the evaluation of pediatric thoracic trauma. In: *Journal of Trauma and Acute Care Surgery*. Lippincott Williams and Wilkins; 2016. p. 271–7.
27. Choi PM, Farmakis S, Desmarais TJ, Keller MS. Management and outcomes of traumatic hemothorax in children. *Journal of Emergencies, Trauma and Shock*. 2015 Apr 1;8(2):83–7.
28. Montes-Tapia F, Barreto-Arroyo I, Cura-Esquivel I, Rodríguez-Taméz A, de La O-Cavazos M. Traumatic Asphyxia (Internet). 2014. Available from: [www.pcc-online.com](http://www.pcc-online.com)
29. Weissberg D, Refaely Y. Pneumothorax: Experience with 1,199 patients. *Chest*. 2000;117(5):1279–85.
30. Barton ED, Rhee P, Hutton KC, Rosen P. THE BATHOPHYSIOLOGY OF TENSION PNEUMOTHORAX IN VENTILATED SWNE. Vol. 15, *The Journal of Emergency Medicine*. Elsevier Science Inc; 1997.

32. Kimbrell BJ, Yamzon J, Petrone P, Asensio JA, Velmahos GC. Intrapleural thrombolysis for the management of undrained traumatic hemothorax: A prospective observational study. *Journal of Trauma - Injury, Infection and Critical Care*. 2007 May;62(5):1175–8.
33. st. Peter SD, Tsao K, Harrison C, Jackson MA, Spilde TL, Keckler SJ, et al. Thoracoscopic decortication vs tube thoracostomy with fibrinolysis for empyema in children: a prospective, randomized trial. *Journal of Pediatric Surgery*. 2009;44(1):106–11.
34. Tutor JD. Chylothorax in infants and children. Vol. 133, *Pediatrics*. American Academy of Pediatrics; 2014. p. 722–33.
35. Kwon A, Sorrells DL, Kurkchubasche AG, Cassese JA, Tracy TF, Luks FI. Isolated computed tomography diagnosis of pulmonary contusion does not correlate with increased morbidity. *Journal of Pediatric Surgery*. 2006;41(1):78–82.
36. Mizushima Y, Hiraide A, Shimazu T, Yoshioka T, Sugimoto H. Changes in contused lung volume and oxygenation in patients with pulmonary parenchymal injury after blunt chest trauma. *American Journal of Emergency Medicine*. 2000;18(4):385–9.
37. Brahim Karnak I, Emin M, Enocak S, Tanyel FC, Büyükpamukçu N. Diaphragmatic Injuries in Childhood. Vol. 31, *Surg Today*. 2001.
38. Ozdulger A, Cetin G, Erkmen Gulhan S, Topcu S, Tasetepe I, Kaya S. A review of 24 patients with bronchial ruptures: is delay in diagnosis more common in children? q. Available from: [www.elsevier.com/locate/ejcts](http://www.elsevier.com/locate/ejcts)
39. Rieth A, Varga E, Kovács T, Otlakán A, Németh T, Furák J. Contemporary management strategies of blunt tracheobronchial injuries. *Injury*. 2021 Mar 1;52:S7–14.
40. Hamilton EC, Lazar D, Tsao K, Cox C, Austin MT. Pediatric tracheobronchial injury after blunt trauma. *Journal of Trauma and Acute Care Surgery*. 2017 Sep 1;83(3):554–6.
41. Asensio JA, Chahwan S, Forno W, Mackersie R, Wall M, Lake J, et al. Penetrating Esophageal Injuries: Multicenter Study of the American Association for the Surgery of Trauma. 2001.
42. Sartorelli KH, McBride WJ, Burlington DWV. Perforation of the Intrathoracic Esophagus From Blunt Trauma in a Child: Case Report and Review of the Literature. 1999.
43. Notrica DM, Eubanks JW, Tuggle DW, Maxson RT, Letton RW, Garcia NM, et al. Nonoperative management of blunt liver and spleen injury in children: Evaluation of the ATOMAC guideline using GRADE. *Journal of Trauma and Acute Care Surgery*. 2015;79(4):683–93.
44. Dodgion CM, Gosain A, Rogers A, st. Peter SD, Nichol PF, Ostlie DJ. National trends in pediatric blunt spleen and liver injury management and potential benefits of an abbreviated bed rest protocol. *Journal of Pediatric Surgery*. 2014;49(6):1004–8.
45. Neff LP, Cannon JW, Morrison JJ, Edwards MJ, Spinnella PC, Borgman MA. Clearly defining pediatric massive transfusion: Cutting through the fog and friction with combat data. *Journal of Trauma and Acute Care Surgery*. 2015 Jan 13;78(1):22–8.
46. Magoteaux SR, Notrica DM, Langlais CS, Linnaus ME, Raines AR, Letton RW, et al. Hypotension and the need for transfusion in pediatric blunt spleen and liver injury: An ATOMAC + prospective study. *Journal of Pediatric Surgery*. 2017 Jun 1;52(6):979–83.
47. Linnaus ME, Notrica DM, Langlais CS, st. Peter SD, Leys CM, Ostlie DJ, et al. Prospective validation of the shock index pediatric-adjusted (SIPA) in blunt liver and spleen trauma: An ATOMAC + study. *Journal of Pediatric Surgery*. 2017 Feb 1;52(2):340–4.
48. Acker SN, Ross JT, Partrick DA, Tong S, Bensard DD. Pediatric specific shock index accurately identifies severely injured children. *Journal of Pediatric Surgery*. 2015 Feb 1;50(2):331–4.
49. Pandit V, Michailidou M, Rhee P, Zangbar B, Kulvattunyou N, Khalil M, et al. The use of whole body computed tomography scans in pediatric trauma patients: Are there differences among adults and pediatric centers? In: *Journal of Pediatric Surgery*. W.B. Saunders; 2016. p. 649–53.
50. Zagory JA, Dossa A, Golden J, Jensen AR, Goodhue CJ, Upperman JS, et al. Re-evaluation of liver transaminase cutoff for CT after pediatric blunt abdominal trauma. *Pediatric Surgery International*. 2017 Mar 1;33(3):311–6.
51. Calder BW, Vogel AM, Zhang J, Mauldin PD, Huang EY, Savoie KB, et al. Focused assessment with sonography for trauma in children after blunt abdominal trauma: A multi-institutional analysis. In: *Journal of Trauma and Acute Care Surgery*. Lippincott Williams and Wilkins; 2017. p. 218–24.
52. Linnaus ME, Langlais CS, Garcia NM, Alder AC, Eubanks JW, Todd Maxson R, et al. Failure of nonoperative management of pediatric blunt liver and spleen injuries: A prospective Arizona-Texas-Oklahoma-Memphis-Arkansas Consortium study. In: *Journal of Trauma and Acute Care Surgery*. Lippincott Williams and Wilkins; 2017. p. 672–9.
53. Kohler JE, Chokshi NK. Management of abdominal solid organ injury after blunt trauma. *Pediatric Annals*. 2016 Jul 1;45(7):e241–6.
54. Notrica DM, Linnaus ME. Nonoperative Management of Blunt Solid Organ Injury in Pediatric Surgery. Vol. 97, *Surgical Clinics of North America*. W.B. Saunders; 2017. p. 1–20.
55. Notrica DM, Eubanks JW, Tuggle DW, Maxson RT, Letton RW, Garcia NM, et al. Nonoperative management of blunt liver and spleen injury in children: Evaluation of the ATOMAC guideline using GRADE. *Journal of Trauma and Acute Care Surgery*. 2015;79(4):683–93.
56. Holmes IV JH, Wiebe DJ, Tataria M, Mattix KD, Mooney DP, Scaife ER, et al. The failure of nonoperative management in pediatric solid organ injury: A multi-institutional experience. *Journal of Trauma - Injury, Infection and Critical Care*. 2005 Dec;59(6):1309–13.
57. Kozar RA, Feliciano D v., Moore EE, Moore FA, Coccour CS, West MA, et al. Western trauma association/

- critical decisions in trauma: Operative management of adult blunt hepatic trauma. *Journal of Trauma - Injury, Infection and Critical Care*. 2011 Jul;71(1):1–5.
58. Golden J, Dossa A, Goodhue CJ, Upperman JS, Gayer CP. Admission hematocrit predicts the need for transfusion secondary to hemorrhage in pediatric blunt trauma patients. In: *Journal of Trauma and Acute Care Surgery*. Lippincott Williams and Wilkins; 2015. p. 555–62.
59. Garvey EM, Haakinson DJ, McOmber M, Notrica DM. Role of ERCP in pediatric blunt abdominal trauma: A case series at a level one pediatric trauma center. *Journal of Pediatric Surgery*. 2015 Feb 1;50(2):335–8.
60. Notrica D. Abdominal and Renal Trauma. In: *Holcomb and Ashcraft's Pediatric Surgery*.
61. Iqbal CW, St Peter SD, Tsao K, Cullinane DC, Gourlay DM, Ponsky TA, et al. Operative vs nonoperative management for blunt pancreatic transection in children: Multi-institutional outcomes. *J Am Coll Surg*. 2014 Feb;218(2):157–62.
62. Naik-Mathuria BJ, Rosenfeld EH, Gosain A, Burd R, Falcone RA, Thakkar R, et al. Proposed clinical pathway for nonoperative management of high-grade pediatric pancreatic injuries based on a multicenter analysis: A pediatric trauma society collaborative. *Journal of Trauma and Acute Care Surgery*. 2017 Oct 1;83(4):589–96.
63. Zhang D, Yan J, Siyin ST, Pang W, Chen Y. Nonresection management of the pancreas for grade III and IV blunt pancreatic injuries in children: a single center's experience. *BMC Pediatrics*. 2021 Dec 1;21(1).
64. Ameh EA, Nmadu PT. GASTROINTESTINAL INJURIES FROM BLUNT ABDOMINAL TRAUMA IN CHILDREN. Vol. 81, *East African Medical Journal*. 2004.
65. Letton RW, Worrell V. Delay in diagnosis and treatment of blunt intestinal injury does not adversely affect prognosis in the pediatric trauma patient. *Journal of Pediatric Surgery*. 2010 Jan;45(1):161–6.
66. Revell MA, Pugh MA, McGhee M. *Gastrointestinal Traumatic Injuries: Gastrointestinal Perforation*. Vol. 30, *Critical Care Nursing Clinics of North America*. W.B. Saunders; 2018. p. 157–66.
67. Tejerina Álvarez EE, Holanda MS, López-Espadas F, Dominguez MJ, Ots E, Díaz-Regañón J. Gastric rupture from blunt abdominal trauma. *Injury*. 2004;35(3):228–31.
68. Goh B, Soundappan SSV. Traumatic duodenal injuries in children: a single-centre study. *ANZ Journal of Surgery*. 2021 Jan 1;91(1–2):95–9.
69. Coccolini F, Kobayashi L, Kluger Y, Moore EE, Ansaloni L, Biffl W, et al. Duodeno-pancreatic and extrahepatic biliary tree trauma: WSES-AAST guidelines. Vol. 14, *World Journal of Emergency Surgery*. BioMed Central Ltd.; 2019.
70. Peterson ML, Abbas PI, Fallon SC, Naik-Mathuria BJ, Rodriguez JR. Management of traumatic duodenal hematomas in children. *Journal of Surgical Research*. 2015 Nov 1;199(1):126–9.
71. Gaines BA, Shultz BS, Morrison K, Ford HR. Duodenal Injuries in Children: Beware of Child Abuse. *Journal of Pediatric Surgery*. 2004;39(4):600–2.
72. Anand RJ, Stern J. Traumatic Decompression of the Jejunum: A Case of Small Bowel Perforation From High-Speed Motor Vehicle Crash.
73. Samuk I, Steiner Z, Feigin E, Baazov A, Dlugy E, Freud E. Anorectal injuries in children: a 20-year experience in two centers. *Pediatric Surgery International*. 2015 Sep 20;31(9):815–9.
74. Katano K, Furutani Y, Hiranuma C, Hattori M, Doden K, Hashidume Y. Anorectal injury related to a personal watercraft: a case report and literature review. *Surgical Case Reports*. 2020 Dec;6(1).
75. *Pediatric Pelvic Fractures*. 2007.
76. Choi PM, Wallendorf M, Keller MS, Vogel AM. Traumatic colorectal injuries in children: The National Trauma Database experience. *Journal of Pediatric Surgery*. 2017;52(10):1625–7.
77. Ball CG. *Damage control surgery*. Vol. 21, *Current Opinion in Critical Care*. Lippincott Williams and Wilkins; 2015. p. 538–43.
78. Balogh Z, McKinley BA, Holcomb JB, Miller CC, Coanour CS, Kozar RA, et al. Both primary and secondary abdominal compartment syndrome can be predicted early and are harbingers of multiple organ failure. *Journal of Trauma*. 2003;52(5):848–61.
79. McALEER IM, Kaplan GW, Scherz HC, Packer MG. GENITOURINARY TRAUMA IN THE PEDIATRIC PATIENT.
80. Singer G, Arneitz C, Tschauener S, Castellani C, Till H. Trauma in pediatric urology. *Seminars in Pediatric Surgery*. 2021 Aug 1;30(4).
81. Alsaywid B, Alkhashan MY, Alrimawi M, Abu-alsaud N, Al-Rimawi H. Blunt renal trauma in pediatric population. *Urology Annals*. 2019 Jul 1;11(3):241–6.
82. LeeVan E, Zmora O, Cazzulino F, Burke R v., Zagory J, Upperman JS. Management of pediatric blunt renal trauma: A systematic review. Vol. 80, *Journal of Trauma and Acute Care Surgery*. Lippincott Williams and Wilkins; 2016. p. 519–28.
83. Levy JB, Bellah R, Baskin LS, Snyder HM, Ewalt DH, Templeton J, et al. NONOPERATIVE MANAGEMENT OF BLUNT PEDIATRIC MAJOR RENAL TRAUMA.
84. Lee JN, Lim JK, Woo MJ, Kwon SY, Kim BS, Kim HT, et al. Predictive factors for conservative treatment failure in grade IV pediatric blunt renal trauma. *Journal of Pediatric Urology*. 2016 Apr 1;12(2):93.e1–93.e7.
85. Hagedorn JC, Fox N, Ellison JS, Russell R, Witt CE, Zeller K, et al. Pediatric blunt renal trauma practice management guidelines: Collaboration between the Eastern Association for the Surgery of Trauma and the Pediatric Trauma Society. In: *Journal of Trauma and Acute Care Surgery*. Lippincott Williams and Wilkins; 2019. p. 916–25.
86. LeeVan E, Zmora O, Cazzulino F, Burke R v., Zagory J, Upperman JS. Management of pediatric blunt renal trauma: A systematic review. Vol. 80, *Journal of Trau-*

- ma and Acute Care Surgery. Lippincott Williams and Wilkins; 2016. p. 519–28.
87. Hadjipavlou M, Grouse E, Gray R, Sri D, Huang D, Brown C, et al. Managing penetrating renal trauma: experience from two major trauma centres in the UK. *BJU International*. 2018 Jun 1;121(6):928–34.
  88. Voelzke BB, McAninch JW. Renal gunshot wounds: Clinical management and outcome. *Journal of Trauma - Injury, Infection and Critical Care*. 2009 Mar;66(3):593–600.
  89. Resch TR, Kufera JA, Chiu W, Scalea TM. Penetrating Renal Trauma: Nonoperative Management Is Safe in Selected Patients.
  90. Brandes S, Eswara J. Upper Urinary Tract Trauma. In: Partin AW, editor. *Campbell-Walsh-Wein Urology*. 12th ed. 2021.
  91. Davis KA, Reed RL, Santaniello J, Abodeely A, Esposito TJ, Poulakidas SJ, et al. Predictors of the need for nephrectomy after renal trauma. Vol. 60, *Journal of Trauma - Injury, Infection and Critical Care*. 2006. p. 164–9.
  92. Jacobs MA, Hotaling JM, Mueller BA, Koyle M, Rivara F, Voelzke BB. Conservative management vs early surgery for high grade pediatric renal trauma - Do nephrectomy rates differ? *Journal of Urology*. 2012;187(5):1817–22.
  93. Redmond EJ, Kiddoo DA, Metcalfe PD. Contemporary management of pediatric high grade renal trauma: 10 year experience at a level 1 trauma centre. *Journal of Pediatric Urology*. 2020 Oct 1;16(5):656.e1–656.e5.
  94. Siram SM, Gerald SZ, Greene WR, Hughes K, Oyetunji TA, Chrouser K, et al. Ureteral trauma: Patterns and mechanisms of injury of an uncommon condition. *American Journal of Surgery*. 2010 Apr;199(4):566–70.
  95. Lee WJ, Lin HJ, Cheng TC, Lin J. Ureteral injury due to blunt abdominal trauma. Vol. 13, *European Journal of Emergency Medicine*. 2006.
  96. Li WM, Liu CC, Wu WJ, Chou YH, Huang CH, Li CC. Rupture of renal pelvis in an adult with congenital ureteropelvic junction obstruction after blunt abdominal trauma. *Kaohsiung Journal of Medical Sciences*. 2007;23(3):142–6.
  97. Smith JK, Kenney PJ. Imaging of renal trauma. Vol. 41, *Radiologic Clinics of North America*. W.B. Saunders; 2003. p. 1019–35.
  98. Soria J, Guandalino M, Vedrine N, Pereira B, Guy L. Results of conservative surgical management of ureteral injuries. *Progres en Urologie*. 2018 Feb 1;28(2):120–7.
  99. Ficarra V, Rossanese M, Crestani A, Caloggero S, Alario G, Novara G, et al. A Contemporary Case Series of Complex Surgical Repair of Surgical/Endoscopic Injuries to the Abdominal Ureter. *European Urology Focus*. 2021 Nov 1;7(6):1476–84.
  100. Hegele A. Nieren- und Ureterverletzungen: Diagnostik und Therapie. *Urologe*. 2016 Apr 1;55(4):460–5.
  101. Guttman I, Kerr HA. Blunt Bladder Injury. Vol. 32, *Clinics in Sports Medicine*. 2013. p. 239–46.
  102. Ishak C, Kanth N. Bladder trauma: Multidetector computed tomography cystography. Vol. 18, *Emergency Radiology*. 2011. p. 321–7.
  103. Bakal U, Sarac M, Tartar T, Ersoz F, Kazez A. Bladder perforations in children. *Nigerian Journal of Clinical Practice*. 2015 Jul 1;18(4):485–8.
  104. Deibert CM, Glassberg KI, Spencer BA. Repair of pediatric bladder rupture improves survival: Results from the National Trauma Data Bank. *Journal of Pediatric Surgery*. 2012 Sep;47(9):1677–81.
  105. Durrant JJ, Ramasamy A, Salmon MS, Watkin N, Sargeant I. Pelvic fracture-related urethral and bladder injury. *J R Army Med Corps*. 2013 Mar 1;159:i32–9.
  106. Sanson S, Ballouhey Q, Abbo O, Galinier P. Mise au point sur la prise en charge des traumatismes de l'urètre antérieur de l'enfant. *Progres en Urologie*. 2013 May;23(6):410–4.
  107. Battaloglu E, Figuero M, Moran C, Lecky F, Porter K. Urethral injury in major trauma. *Injury*. 2019 May 1;50(5):1053–7.
  108. Rosenstein DI, Alsikafi NF. Diagnosis and classification of urethral injuries. Vol. 33, *Urologic Clinics of North America*. 2006. p. 73–85.
  109. Brandes S. Initial management of anterior and posterior urethral injuries. Vol. 33, *Urologic Clinics of North America*. 2006. p. 87–95.
  110. Voelzke BB, Breyer BN, McAninch JW. Blunt pediatric anterior and posterior urethral trauma: 32-year experience and outcomes. *Journal of Pediatric Urology*. 2012 Jun;8(3):258–63.
  111. Glaser ZA, Singh N, Koch C, Dangle PP. Pediatric female genital trauma managed under conscious sedation in the emergency department versus general anesthesia in the operating room- a single center comparison of outcomes and cost. *Journal of Pediatric Urology*. 2021 Apr 1;17(2):236.e1–236.e8.
  112. Pichler R, Fritsch H, Skradski V, Horninger W, Schlenck B, Rehder P, et al. Diagnosis and management of pediatric urethral injuries. Vol. 89, *Urologia Internationalis*. 2012. p. 136–42.
  113. Merritt DF. Genital Trauma in the Pediatric and Adolescent Female. Vol. 36, *Obstetrics and Gynecology Clinics of North America*. 2009. p. 85–98.
  114. Roaten JB, Partrick DA, Nydam TL, Bensard DD, Hendrickson RJ, Sirotnak AP, et al. Nonaccidental trauma is a major cause of morbidity and mortality among patients at a regional level 1 pediatric trauma center. *Journal of Pediatric Surgery*. 2006 Dec;41(12):2013–5.
  115. Oehmichen M, Schleiss D, Pedal I, Saternus KS, Gerling I, Meissner C. Shaken baby syndrome: Re-examination of diffuse axonal injury as cause of death. *Acta Neuropathologica*. 2008;116(3):317–29.
  116. Wood J, Rubin DM, Nance ML, Christian CW. Distinguishing inflicted versus accidental abdominal injuries in young children. Vol. 59, *Journal of Trauma - Injury, Infection and Critical Care*. 2005. p. 1203–8.
  117. Rawlins JM, Khan AA, Shenton AF, Sharpe DT. Epidemiology and Outcome Analysis of 208 Children With Burns Attending an Emergency Department. 2007.
  118. Strobel AM, Fey R. Emergency Care of Pediatric Burns. Vol. 36, *Emergency Medicine Clinics of North America*. W.B. Saunders; 2018. p. 441–58.