EVIDENCE-BASED GUIDELINES FOR BLUNT ABDOMINAL TRAUMA IN CHILDREN

Tuychibekov Shukurbek Makhmudovich
Senior lecturer, PhD, FMIOPH, Fergana, Uzbekistan
Nishanov Eshonkhoja Khamedkhoja ugli
Assistant of Traumatology and Orthopedics Department, FMIOPH, Fergana, Uzbekistan
Eminov Ravshanjon Ikromjon Ugli
Assistant of Faculty and Hospital Surgery Department, FMIOPH, Fergana, Uzbekistan
eshonxojanishonov@gmail.com

Abstract: This article presents evidence-based recommendations for managing blunt abdominal trauma in children. It emphasizes the importance of non-operative management for stable patients, evaluates diagnostic imaging techniques like ultrasound and CT, and outlines the roles of surgery, monitoring, and interventional radiology. The approach is aimed at improving outcomes while minimizing unnecessary interventions.
Keywords: blunt abdominal trauma, pediatrics, non-operative management, diagnostic imaging
Аннотация: В статье представлены рекомендации, основанные на доказательной медицине, по лечению тупой травмы живота у детей. Особое внимание уделяется неоперативному подходу у стабильных пациентов, рассматриваются методы диагностики, такие как УЗИ и КТ, а также роль хирургии, наблюдения и интервенционной радиологии. Такой подход направлен на улучшение исходов и снижение ненужных вмешательств.
Ключевые слова: тупая травма живота, педиатрия, консервативное лечение, диагностическая визуализация
Annotatsiya: Ushbu maqolada bolalarda qorinning yopiq shikastlanishini boshqarish bo‘yicha dalillarga asoslangan tavsiyalar keltirilgan. Gemodinamik jihatdan barqaror bemorlarda operatsiyasiz yondashuvga urg‘u berilgan, diagnostik tekshiruv usullari, jumladan, UTT va KT tahlil qilingan, shuningdek, jarrohlik, kuzatuv va intervension radiologiya roli yoritilgan. Yondashuv natijalarni yaxshilash va ortiqcha muolajalarni kamaytirishga qaratilgan.
Kalit so‘zlar: qorin yopiq shikastlanishi, pediatriya, operatsiyasiz davolash, diagnostik tasvirlash

Introduction

The management of blunt abdominal trauma in children has evolved significantly, with a strong emphasis on non-operative management (NOM) for hemodynamically stable patients. Historically, surgical intervention was the standard, but it often proved unsuccessful, leading to the development of evidence-based guidelines that prioritize NOM based on the physiologic status and response to medical interventions rather than solely on radiologic injury grading[1] [2]. Diagnostic imaging plays a crucial role in the evaluation of pediatric blunt abdominal trauma, with computed tomography (CT) being the gold standard for stable patients due to its high sensitivity and accuracy in identifying solid organ injuries[4] [5]. However, due to concerns about radiation exposure, the use of CT is guided by the ALARA principle, and alternative imaging modalities like contrast-enhanced ultrasound (CEUS) are considered for low-energy trauma cases[4] [5]. The Focused Assessment with Sonography for Trauma (FAST) is particularly useful in unstable patients to quickly assess for hemoperitoneum, although a negative FAST does not rule out significant injury[8] [10]. The spleen is the most commonly injured organ in blunt abdominal trauma, and current guidelines favor splenic conservation over splenectomy to reduce perioperative risks and long-term complications such as

overwhelming post-splenectomy infection[7] [8]. Non-operative management of splenic injuries has a high success rate, supported by advances in intensive care and interventional radiology, such as angio-embolization, which has increased the success of NOM by 15% in stable patients[8]. Ultimately, the decision to operate is based on the child's hemodynamic stability post-resuscitation, with NOM being the preferred approach for most solid organ injuries, provided the patient remains stable[6] [9]. This comprehensive approach, integrating diagnostic imaging, physiologic assessment, and evidence-based guidelines, aims to optimize outcomes and minimize unnecessary surgical interventions in pediatric blunt abdominal trauma cases.

Diagnostic imaging techniques

Role of Ultrasound

Ultrasound, particularly the Focused Assessment with Sonography for Trauma (FAST), is widely used as an initial imaging modality in pediatric BAT. FAST is non-invasive, quick, and does not expose children to radiation. However, its sensitivity for detecting intra-abdominal injuries is relatively low (20.3%), though it has high specificity (87%) [14] [17]. A systematic review and meta-analysis of FAST in pediatric trauma found that while a positive FAST result strongly suggests intra-abdominal injury, a negative result does not rule it out and may require further imaging [17].

Contrast-enhanced ultrasound (CEUS) has emerged as a promising alternative to CT scans. Studies have shown that CEUS has high sensitivity (88.5%) and specificity (98.5%) for detecting solid organ injuries, making it a valuable tool for reducing radiation exposure in children [11] [16].

Computed Tomography (CT)

CT remains the gold standard for diagnosing intra-abdominal injuries in children due to its high accuracy. However, concerns about radiation exposure have led to efforts to reduce its use. A clinical prediction rule incorporating parameters such as abdominal pain, physical examination findings, aspartate aminotransferase (AST) levels, and chest X-ray (CXR) can help identify low-risk patients who may not require CT scans [20]. Additionally, the Paediatric polytrauma CT-Indication (PePCI)-Score has been developed to reduce unnecessary CT scans by identifying patients at low risk of severe injuries [13].

Table 1. Comparison of imaging modalities

Imaging Modality	**Effectiveness**	**Citation**
FAST Ultrasound	High specificity (87%), low sensitivity (20.3%)	[14] [17]
CEUS	High sensitivity (88.5%) and specificity (98.5%)	[11] [16]
CT Scan	Gold standard for diagnosis, but efforts to reduce use due to radiation concerns	[13]

Surgical Interventions

Indications for Surgery

Surgical intervention is typically reserved for hemodynamically unstable patients or those with severe injuries. The American Pediatric Surgical Association (APSA) guidelines emphasize that operative management should be based on physiological status rather than injury grade alone [2] [4]. For example, high-grade pancreatic injuries involving the main pancreatic duct may require surgical intervention or endoscopic retrograde cholangiopancreatography (ERCP) [9].

Angioembolization

Angioembolization is increasingly used as an adjunct to non-operative management, particularly for renal injuries. However, its use in children is less common compared to adults, and it is typically reserved for cases with ongoing bleeding or hemodynamic instability [4] [6].

Non-Operative Management (NOM)

Principles of NOM

Non-operative management has become the standard of care for hemodynamically stable children with blunt solid organ injuries. The APSA guidelines, first introduced in 2000, advocate for NOM as the primary approach for such injuries, emphasizing the importance of minimizing invasive procedures and hospitalization [1] [2]. Studies have shown that NOM is safe and effective, with low rates of complications and mortality [7] [10].

Monitoring and Follow-Up

Children managed non-operatively require close monitoring, including regular clinical assessments, laboratory tests, and imaging. The use of injury grading systems, such as the Abbreviated Injury Scale (AIS), helps guide management decisions. For example, low-grade injuries (I-II) are typically managed conservatively, while high-grade injuries (III-V) may require more intensive monitoring and possibly intervention [4] [9].

Role of Interventional Radiology

Interventional radiology, including angioembolization and ERCP, has expanded the scope of NOM for complex injuries. These techniques allow for minimally invasive management of bleeding or ductal injuries, reducing the need for surgery [9] [10].

Special Considerations

Hollow Viscus Injuries

Hollow viscus injuries, such as small bowel and colon injuries, present unique challenges in pediatric trauma. These injuries often require operative management, though non-operative approaches may be considered in select cases. Diagnostic imaging, particularly CT, plays a critical role in identifying these injuries and guiding management [8].

High-Grade Pancreatic Injuries

High-grade blunt pancreatic injuries involving the main pancreatic duct are rare but require specialized care. Recent trends suggest an increasing use of NOM and ERCP for these injuries, with favorable outcomes [9].

Cost and Resource Utilization

The implementation of evidence-based guidelines has been shown to reduce healthcare costs by minimizing unnecessary imaging, hospitalization, and surgical interventions. For example, the use of clinical prediction rules and injury protocols can help optimize resource utilization while maintaining patient safety [10].

Conclusion

The management of blunt abdominal trauma in children has evolved significantly, with a shift toward non-operative approaches and reduced reliance on imaging and surgical interventions. Evidence-based guidelines emphasize the importance of physiological status, injury grading, and imaging modalities in guiding treatment decisions. Continued research is needed to address gaps in current recommendations and to optimize care for pediatric trauma patients.

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