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EARLY CT ASSESSMENT OF VISCERAL PERFUSION AS A PREDICTOR OF ADVERSE OUTCOMES IN ABDOMINAL SURGERIES

Abstract

Adverse outcomes after abdominal surgery are frequently associated with early disturbances of visceral microcirculation that precede clinical and laboratory deterioration. Computed tomography (CT), particularly contrast-enhanced multiphasic imaging and CT perfusion techniques, enables early visualization and quantitative assessment of visceral perfusion. The aim of this study is to evaluate the prognostic value of early CT-based visceral perfusion parameters in predicting adverse postoperative outcomes following abdominal surgeries.

Keywords: computed tomography; visceral perfusion; CT perfusion; abdominal surgery; postoperative ischemia; microcirculatory dysfunction; adverse outcomes; early diagnosis; prognostic imaging markers.

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QORIN BO'SHLIG'I OPERATSIYALARIDA NOXUSH NATIJALARNING BASHORATI SIFATIDA VISSERAL PERFUZIYANI ERTA KT BAHOLASH

Abstrakt

Abdominal jarrohlikdan keyingi salbiy natijalar ko'pincha klinik va laboratoriya yomonlashuvidan oldin visseral mikrotsirkulyatsiyaning erta buzilishlari bilan bog'liq. Kompyuter tomografiyasi (KT), ayniqsa kontrastli ko'p fazali tasvirlash va KT perfuziya usullari visseral perfuziyani erta ko'rish va miqdoriy baholash imkonini beradi. Tadqiqotning maqsadi qorin bo'shlig'i a'zolarida o'tkazilgan operatsiyalardan keyingi noxush oqibatlarni bashoratlashda erta KT asosida visseral perfuziya ko'rsatkichlarining prognostik qiymatini baholashdan iborat.

Tayanch iboralar: kompyuter tomografiya; visseral perfuziya; KT perfuziyasi; abdominal jarrohlik; operatsiyadan keyingi ishemiya; mikrotsirkulyator disfunktsiya; noxush oqibatlar; erta tashxis qo'yish; prognostik tasvirlash belgilari.

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РАННЯЯ КТ-ОЦЕНКА ВИСЦЕРАЛЬНОЙ ПЕРФУЗИИ КАК ПРЕДСКАЗАТЕЛЬ НЕБЛАГОПРИЯТНЫХ ИСХОДОВ ПРИ БРЮШНЫХ ХИРУРГИЯХ

Абстракт

Неблагоприятные исходы после абдоминальных операций часто связаны с ранними нарушениями висцеральной микроциркуляции, предшествующими клинико-лабораторным ухудшениям. Компьютерная томография (КТ), особенно многофазная визуализация с контрастным усилением и методы КТ-перфузии, позволяет на ранней стадии визуализировать и количественно оценить висцеральную перфузию. Целью данного исследования является оценка прогностической ценности ранних показателей висцеральной перфузии на основе КТ в прогнозировании неблагоприятных исходов после операций на животе.

Ключевые слова: компьютерная томография; висцеральная перфузия; КТ-перфузия; абдоминальная хирургия; послеоперационная ишемия; микроциркуляторная дисфункция; неблагоприятные исходы; ранняя диагностика; прогностические маркеры визуализации.

Introduction

Despite advances in surgical techniques and perioperative care, postoperative complications such as anastomotic leakage, bowel ischemia, intra-abdominal sepsis, and multiorgan failure remain major causes of morbidity and mortality. These complications often originate from early microcirculatory impairment affecting the intestine and parenchymal organs.

Clinical signs and laboratory biomarkers of ischemia are frequently delayed or nonspecific. In contrast, CT provides direct assessment of tissue perfusion and viability. Early CT evaluation of visceral perfusion has emerged as a promising tool for risk stratification and individualized postoperative management.

Table 1. CT indicators of visceral hypoperfusion and clinical significance

CT finding	Interpretation	Prognostic value
Reduced bowel wall enhancement	Decreased perfusion	High
Heterogeneous organ enhancement	Microcirculatory dysfunction	High
Mesenteric venous congestion	Impaired outflow	Moderate–high
Hypoattenuating segments	Focal ischemia	High
Delayed contrast uptake	Perfusion delay	Moderate

Materials and Methods

Early postoperative CT was performed within the first 24–72 hours after abdominal surgery or earlier in cases of clinical suspicion. The protocol included non-contrast CT and portal venous phase contrast-enhanced CT; arterial and delayed phases were added when indicated.

The following CT perfusion-related parameters were analyzed:

- degree and homogeneity of organ enhancement;
- regional attenuation values (HU) of bowel wall and solid organs;
- presence of hypoenhancing segments;

- mesenteric fat stranding and venous congestion;
- signs of delayed contrast wash-in or wash-out.

CT findings were correlated with clinical outcomes, including postoperative complications, need for reintervention, and mortality.

Figure 1. Early CT signs of visceral hypoperfusion



Results

Patients who developed adverse outcomes demonstrated early CT signs of visceral hypoperfusion. The most significant predictors included heterogeneous bowel wall enhancement, focal hypoattenuation of intestinal segments, reduced hepatic and splenic enhancement, and mesenteric venous congestion.

Quantitative analysis revealed that decreased bowel wall attenuation and asymmetric perfusion patterns were strongly associated with an increased risk of anastomotic leakage and ischemic complications. These CT changes often preceded laboratory abnormalities and clinical deterioration.

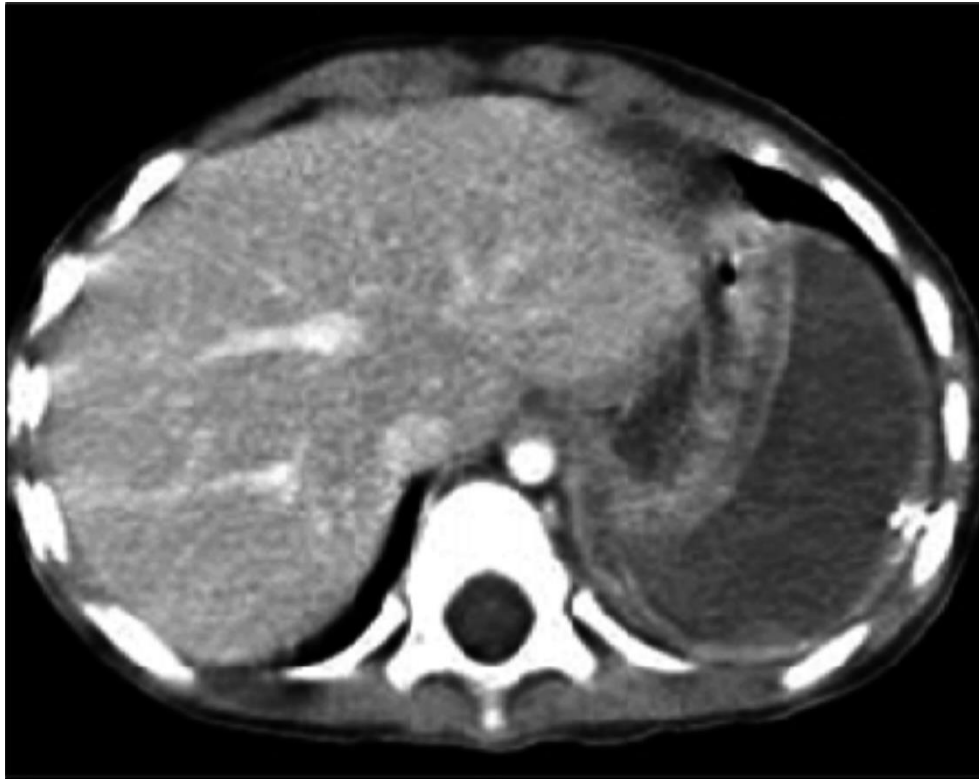


Figure 2. Mesenteric and parenchymal perfusion abnormalities

Discussion

Early visceral hypoperfusion reflects systemic and regional microcirculatory failure, which plays a key role in postoperative complications. CT allows objective visualization of these early changes and provides prognostic information beyond conventional monitoring.

Incorporating CT-based perfusion assessment into postoperative algorithms may facilitate early therapeutic interventions, including hemodynamic optimization, antibiotic therapy, or timely surgical revision. Thus, CT serves not only as a diagnostic but also as a decision-support tool in personalized surgical care.

Conclusion

Early CT assessment of visceral perfusion is a valuable predictor of adverse outcomes in abdominal surgeries. Detection of subclinical hypoperfusion enables early risk stratification and optimization of postoperative management, potentially reducing complication rates and improving patient outcomes.

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