

Detection of Early Postoperative Active Bleeding After Liver Transplantation in Pediatric Patients Using 384-Slice CT Angiography

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Introduction

Liver transplant (LT) is a complex procedure often associated with postoperative complications, including bleeding events. Early detection of active bleeding is critical for timely intervention and improved patient outcomes. This retrospective observational study aimed to assess the efficacy of 384-slice computed tomography (CT) angiography (CTA) for detection of early postoperative active bleeding events after LT.

Materials and Methods

A retrospective analysis was conducted on data collected from 53 liver transplant recipients from February 1, 2022, to December 26, 2023.

Of these patients, 35 had an age range of 7 months to 18 years. All patients underwent 384-slice CTA (Siemens SOMATOM Force Dual Source CT).

Arterial, venous, and delayed phases with 0.5-mm slice thickness were obtained.

The CT scans were performed for patients with symptoms suggesting bleeding. The contrast material dose was adjusted according to the patient's weight. The injection rate of contrast material varied between 0.7 and 2 mL/s.

Results

Approximately 31,42% of the patients experienced bleeding, with 28,57% presenting with active bleeding complications.

Additionally, 3.77% of patients had repetitive bleeding, with one patient experiencing three episodes and another two episodes. All bleeding events originated from the perihepatic region near the site of anastomosis, predominantly arterial (97.22%) and only one venous (2.78%).

The time intervals between the day of surgery and the onset of active bleeding ranged from day 1 to 14, with a mean time interval of 5.83 days.

All patients with active bleeding underwent either conventional angiography or exploratory laparotomy for hemostasis. The site of bleeding was confirmed in all cases.

The sensitivity, specificity, and positive predictive value of 384-slice CT angiography for detecting early postoperative active bleeding were 100%.

This indicates that the imaging modality accurately identified all instances of active bleeding, providing a reliable means for prompt intervention

Discussion

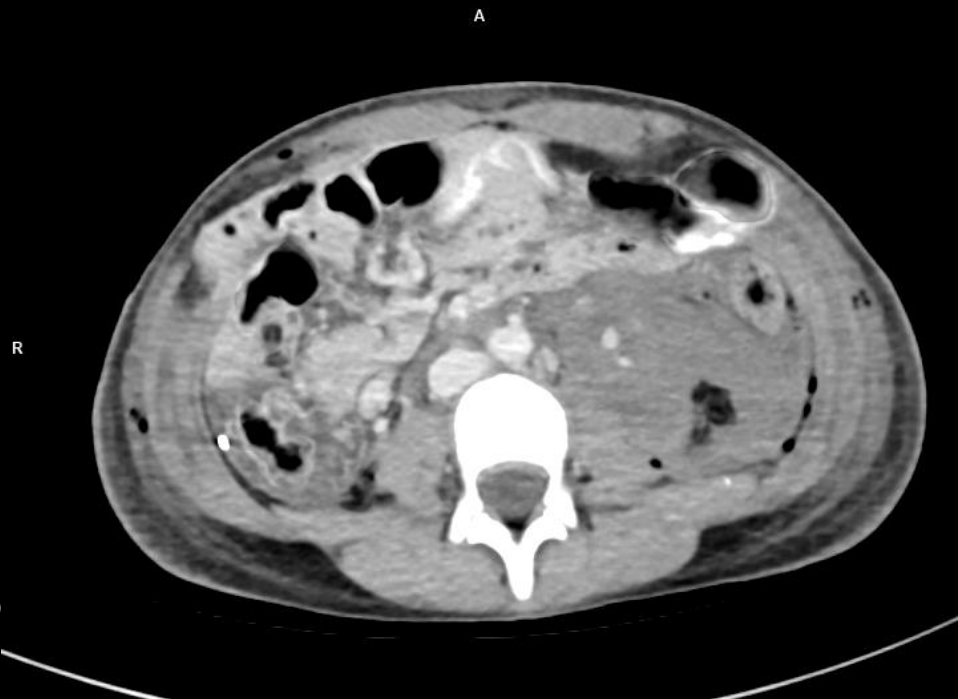
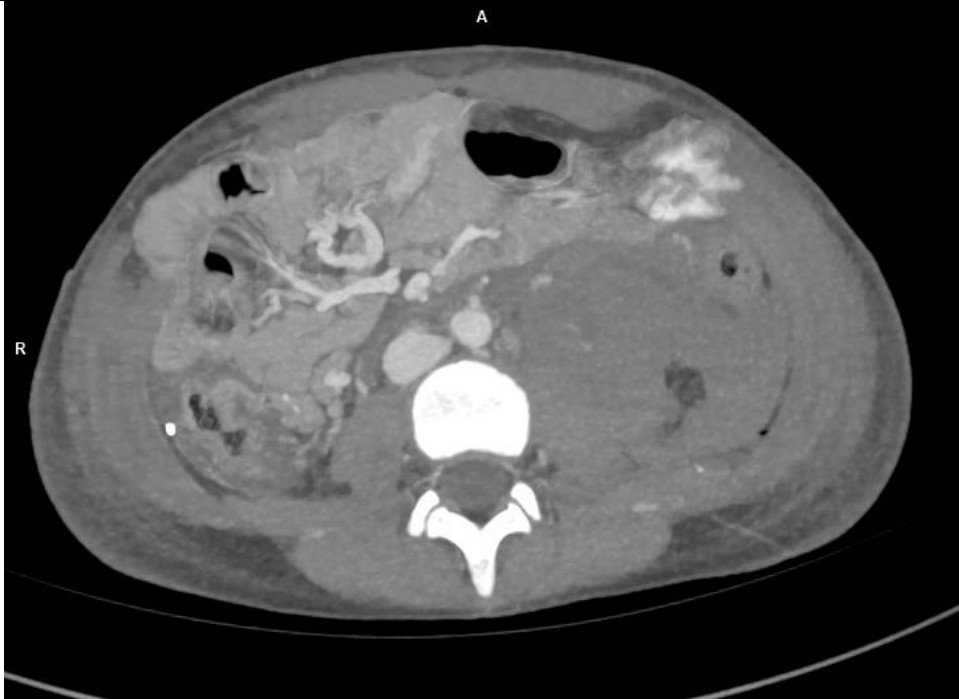
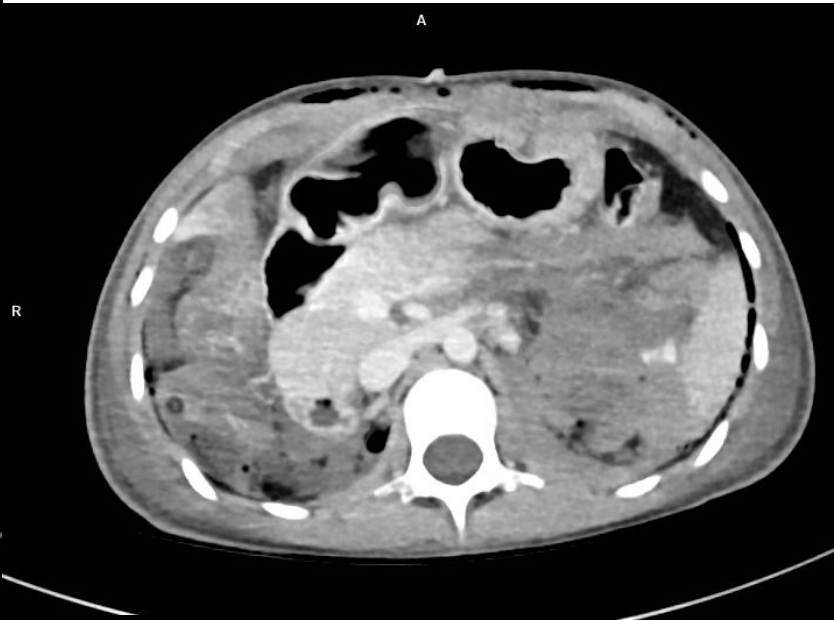
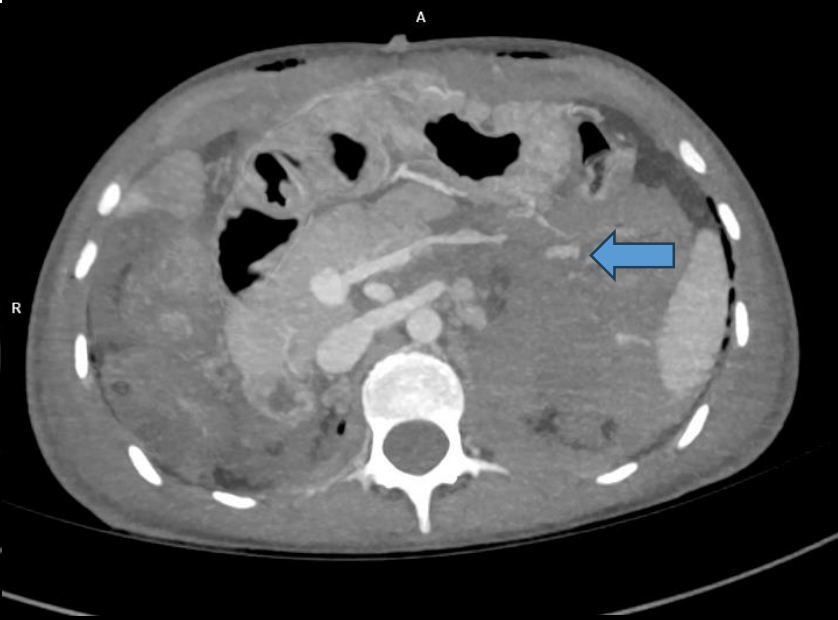
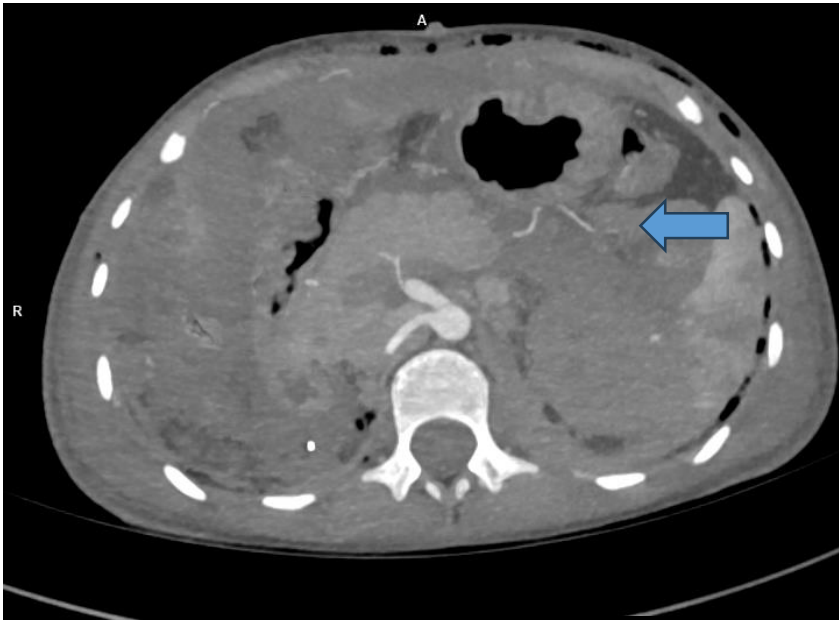
Acute postoperative bleeding following liver transplantation (LT) is a frequent complication, often stemming from various aspects of the surgical process, including donor liver harvesting, recipient hepatectomy, and vascular anastomosis. In the donor liver harvest procedure, inadequate surgical hemostasis at the cut surface of the partial liver graft, the gallbladder bed, the detachment site of the liver capsule, and undetected small veins draining into the vena cava can serve as potential sources of postoperative bleeding.

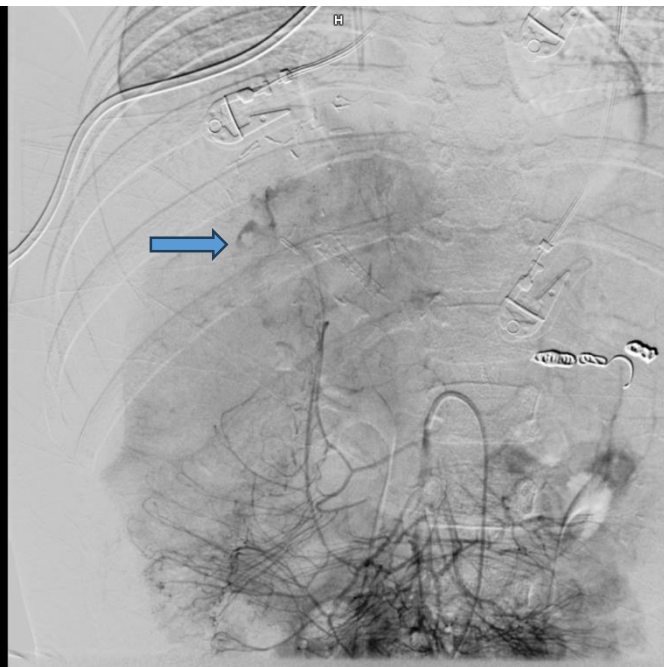
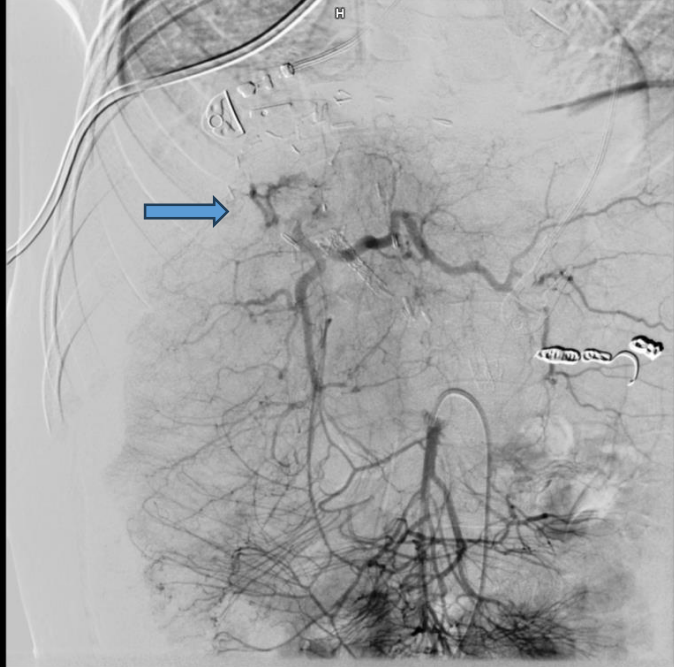
During recipient hepatectomy, severe adhesions between the diseased liver and the posterior abdominal wall can result in injury to organs or vessels within the peritoneal cavity, such as the adrenal gland, right inferior phrenic, or suprarenal artery, due to rigorous traction and dissection. This can lead to recurrent postoperative bleeding. Additionally, postoperative bleeding may stem from various vascular anastomoses, particularly in patients with compromised initial graft function and inadequate synthesis of coagulation factors.

- However, clinical presentation alone often lacks specificity and doesn't pinpoint the bleeding source, making treatment decisions challenging. Multiphase CT imaging offers a solution by revealing active contrast extravasation, indicating the site and extent of bleeding, thus guiding treatment decisions more accurately. Multiphase CT also extends the time frame for observing hemodynamic changes and tracks bleeding progression in a single procedure.
- To our knowledge, there is a lack of specific studies investigating the efficacy of CT angiography in detecting active bleeding in the pediatric population.
- In our study, we categorized the morphologic patterns of active contrast extravasation into focal or stippled and jet-like types.
- The importance of the contrast extravasation pattern, especially during the portal venous phase, in determining the therapeutic approach.
- Furthermore, we observed a significant relationship between the change in morphologic pattern of contrast extravasation from type I to type II and conservative management failure, suggesting a potential indicator of bleeding dynamics. Specifically, the jet-like extravasation pattern, particularly developed from focal extravasation, may signal faster bleeding progression and the need for active therapeutic intervention.
- Among the all bleeding sites identified by surgery or angiography in patients, bleeding originating from peri-anastomosis was the most common.

Conclusions

- The advanced capabilities of 384-slice CT, including high resolution, noninvasiveness, high sensitivity, specificity, and positive predictive value, advocate for the seamless integration of this tool into routine postoperative surveillance protocols.
- This incorporation significantly enhances the timely identification and localization of bleeding sites, leading to improved patient outcomes.





Digital subtraction angiogram obtained with selective catheterization 1 hr of multidetector CT revealed extravasation and extraparenchymal accumulation of extravasated contrast material (arrows).

- **References**

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