Case Report

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Current strategy for hollow viscus injury with active bleeding: A case report

Hiroyuki Otsuka, Tomokazu Fukushima, Youhei Tsubouchi, Keiji Sakurai and Sadaki Inokuchi

Abstract

Despite rapid advancements in medical technologies, the use of interventional radiology in a patient with hemodynamic instability or hollow viscus injury remains controversial. Here, we discuss important aspects regarding the use of interventional radiology for such patients. A 74-year-old Japanese male climber was injured following a 10 m fall. On admission, his systolic blood pressure was 40 mmHg. He had disturbance of consciousness and mild upper abdominal pain without peritoneal irritation. Focused assessment sonography for trauma indicated massive hemorrhage in the intra-abdominal cavity. Plain radiographs revealed hemopneumothorax with right-side rib fractures. Thoracostomy to the right thoracic cavity and massive transfusion were immediately performed. Consequently, a sheath catheter was inserted into the common femoral artery for interventional radiology. His systolic blood pressure increased to 80 mmHg owing to rapid transfusion. In the computed tomography scan room, based on computed tomography findings, we judged that it was possible to achieve hemostasis by interventional radiology. The time from hospital admission to entering the angiography suite was 38 min. Transcatheter arterial embolization for hemorrhage control was performed without complications. Following transcatheter arterial embolization, he was admitted to the intensive care unit. All injuries could be treated conservatively without surgery. His post-interventional course was uneventful, and he recovered completely after rehabilitation. Hemorrhage control using interventional radiology should be assessed as a first-line treatment, even in hemodynamically unstable patients having a hollow viscus injury with active bleeding, without obvious findings that indicate surgical repair.

Keywords

Interventional radiology, trauma, hemodynamic instability, stomach injury

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Introduction

New technologies, such as interventional radiology (IVR), have been developed for trauma patients.[1,2] However, the effectiveness of IVR for treating active hemorrhage following hollow viscus injury remains controversial, especially with hemodynamic instability. We report a hemodynamically unstable severe trauma patient who had a stomach injury with multiple ruptured arteries, who was non-surgically managed by IVR without complications. In addition, we discuss important aspects regarding the use of IVR for such patients.

Case presentation

A 74-year-old Japanese male climber was injured following a 10 m fall. Although alert on arrival, his condition deteriorated. His Glasgow coma scale score was E3V4M6; respiratory rate, 24 breaths/min; pulse rate, 142 beats/min; and systolic blood pressure (SBP), 40 mmHg. Disturbance of consciousness and mild upper abdominal pain without signs of peritoneal irritation was noted. Laboratory evaluation revealed abnormal findings; base excess was −13.0 mmol/L, and white blood cell count, D-dimer, and serum lactate levels were elevated at 19,200 mm^{-3}, 80.2 µg/mL, and 104 mg/dL, respectively. Focused assessment sonography for trauma

Department of Emergency and Critical Care Medicine, Tokai University School of Medicine, Kanagawa, Japan

Corresponding Author:
Hiroyuki Otsuka, Department of Emergency and Critical Care Medicine, Tokai University School of Medicine, 143 Shimokasuya, Isehara 259-1193, Kanagawa, Japan.
Email: hirootsu@is.icc.u-tokai.ac.jp

indicated intra-abdominal cavity fluid collection. Plain radiographs showed hemopneumothorax with right-side rib fractures. Massive intra-abdominal hemorrhage and right hemopneumothorax were believed to be the cause of hemodynamic instability. Thoracostomy to the right thoracic cavity and massive transfusion were performed. A sheath catheter was inserted into the common femoral artery for IVR with resuscitative endovascular balloon occlusion of the aorta (REBOA) 10 min after admission. SBP increased to 80 mmHg following rapid transfusion. Initially, 250 mL of fluid was drained from the right thoracic cavity; active hemorrhage from the thoracic cavity did not continue. Computed tomography (CT) was performed, and based on CT findings of massive intra-abdominal hemorrhage accompanied by arterial extravasation from the peri-pyloric portion of stomach, we judged that it was possible to achieve hemostasis by IVR (Figure 1(a)–(c)); the patient was transferred to the emergency department angiography suite (AS). Volumes of red blood cells (RBCs) and fresh frozen plasma transfused prior to intervention were 840 and 480 mL, respectively. The time from admission to AS was 38 min.

SBP dropped to 70 mmHg on arrival to the AS. Celiac angiography (Figure 2(a)) was performed using a 4F Shepherd hook-type catheter (Terumo, Japan). Next, a microcatheter with a 1.7F tip—Akatsuki (Gadelius Medical, Japan) was advanced into the left gastric artery via the catheter, and embolization achieved by placing 0.018″ microcoils (Tornado, HILAL; Cook Medical) from distal to proximal sides of the injured site. The microcatheter was advanced into the right gastric artery via the left hepatic artery and into the right gastroepiploic artery via the gastroduodenal artery, and super-selective embolization was achieved by placing 0.018″ microcoils (HILAL; Cook Medical) and gelatin sponge, respectively (Figure 2(b) and (c)).

Owing to the massive transfusions, the hemoglobin level was maintained and blood coagulopathy was prevented until IVR was completed. Vital signs stabilized following transcatheter arterial embolization, abdominal symptoms had not deteriorated, and obvious major lacerations, contusions, or perforation of the stomach wall were not seen on initial CT findings; hence, he was admitted to the intensive care unit.

The following diagnoses were made: acute subdural hematoma with large scalp avulsion, fractures in the right side of the 6th–9th ribs, right hemopneumothorax, bilateral lung contusions, hepatic injury, and non-perforated stomach injury with injuries to the left and right gastric arteries and the right gastroepiploic artery. His revised trauma score, injury severity score, and probability of survival calculated by Trauma and Injury Severity Score were 5.643, 48, and 16.3%, respectively.

All injuries were treated without surgery. After 5 days, we performed upper gastrointestinal endoscopy; submucosal hematoma and ulcerative change in the pyloric region were observed (Figure 3).

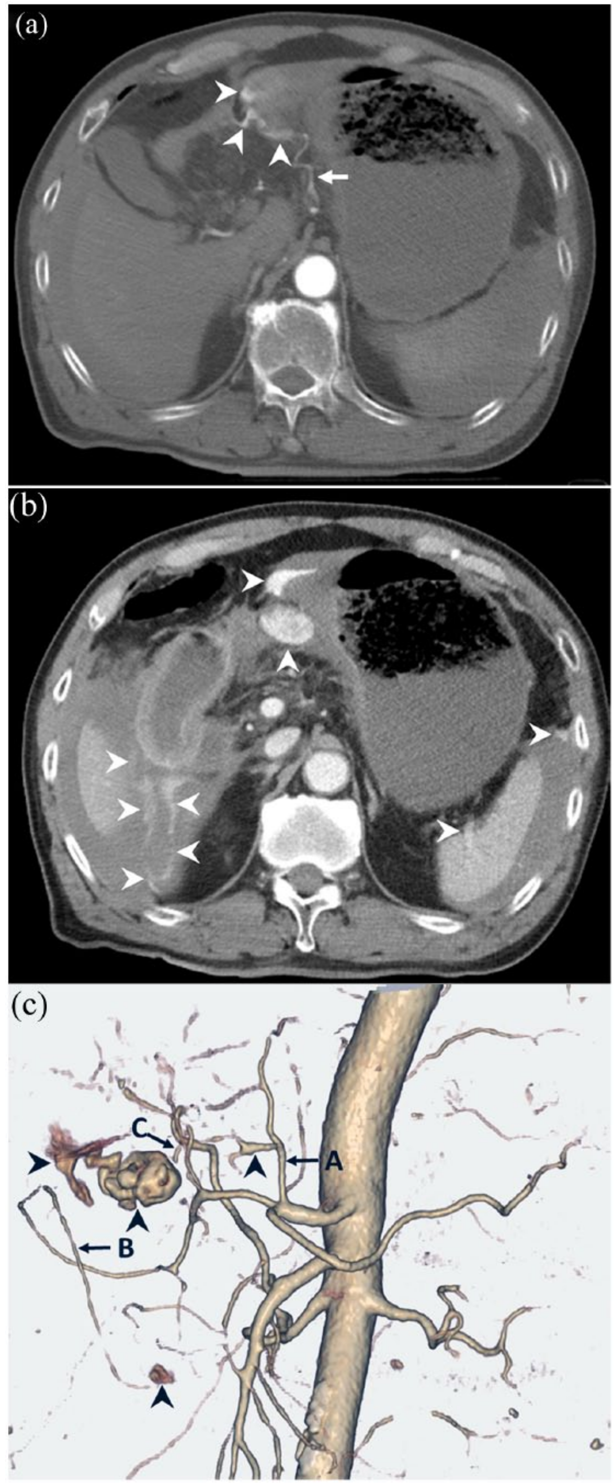

Figure 1. (a) Abdominal computed tomography (CT) scan, arterial phase. The arrow indicates the left gastric artery. The arrowheads show contrast medium extravasations. (b) Abdominal CT scan, venous phase. The arrowheads show extravasations spreading to the peri-stomach, left subphrenic space, and peri-hepatic space. (c) Three-dimensional volume-rendered CT angiogram. Label A represents the left gastric artery, label B represents the right gastroepiploic artery, and label C represents the right gastric artery. The arrowheads show contrast medium extravasations.

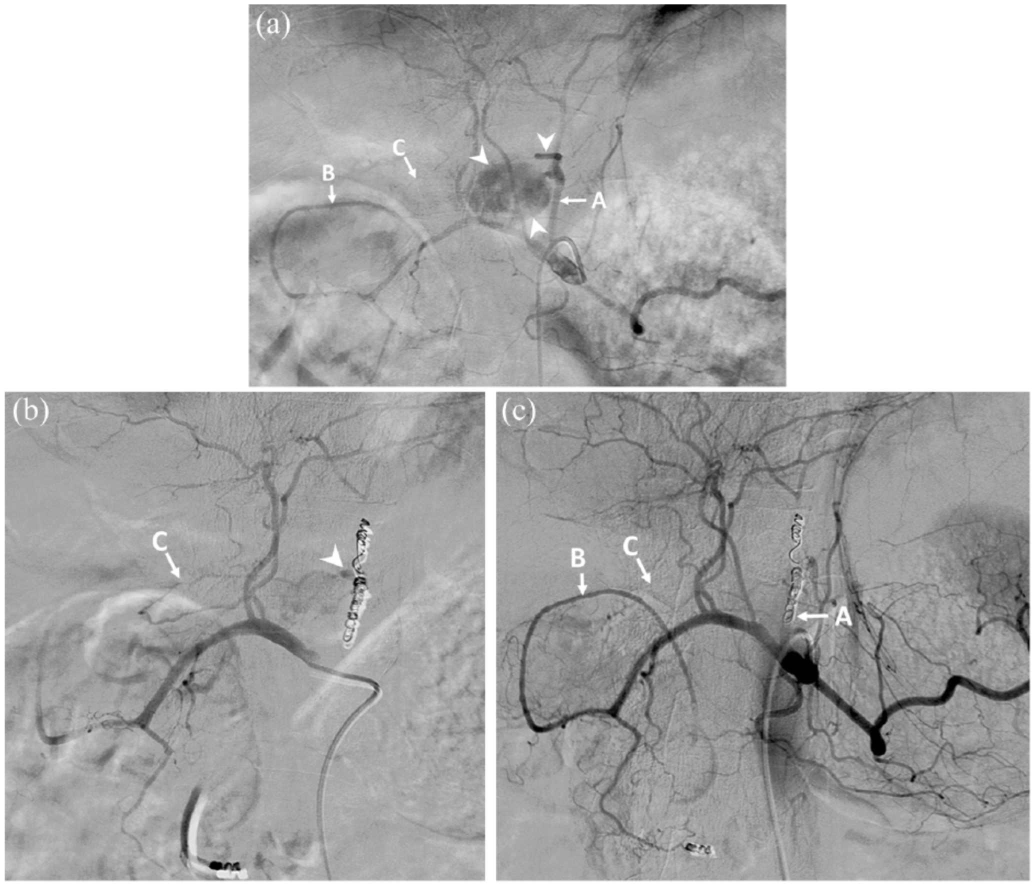

Figure 2. (a) An angiogram of the celiac artery. Label A represents the left gastric artery, label B represents the right gastroepiploic artery, and label C represents the right gastric artery. The arrowheads show contrast medium extravasations. (b) An angiogram of the common hepatic artery. Label C represents the right gastric artery. The arrowhead shows contrast medium extravasation. The left gastric artery and right gastroepiploic artery were occluded using microcoils. (c) Post-transarterial embolization. Label A represents the left gastric artery, label B represents the right gastroepiploic artery, and label C represents the right gastric artery. These arteries were occluded using gelatin sponge and microcoils.

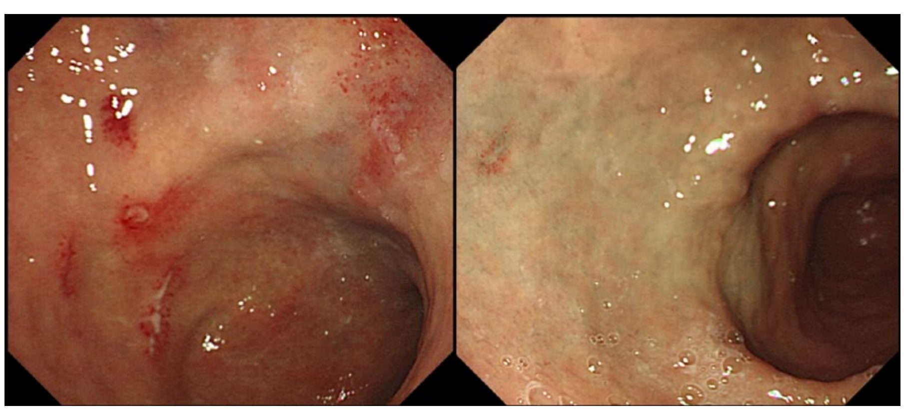

Figure 3. The upper gastrointestinal endoscopy. Submucosal hematoma and ulcerative change in the pyloric region were observed.

The patient recovered completely and was discharged after 2 weeks. Informed patient consent was obtained for publication.

Discussions

We could prevent laparotomy by successfully performing hemorrhage control using IVR in a hemodynamically unstable patient who had a hollow viscus injury with active bleeding, without findings that indicated requirement of surgical repair. As a result, this patient was discharged early without complications.

Generally, urgent surgery is required when either hemodynamic instability, signs of frank peritonitis, loss of intestinal continuity, pneumoperitoneum, contrast extravasation, or mesenteric ischemia are present.[3]

Non-operative management (NOM) has become the standard of care for patients who have blunt solid-organ injuries but are hemodynamically stable.[4,5] Although the diagnostic rate of blunt hollow viscus or mesenteric injury has improved owing to advancements in CT techniques,[6–8] in many studies, patients undergo non-therapeutic laparotomy.[3] Moreover, it was assumed in one current study that early surgery improves outcomes in patients with hollow viscus injury caused by blunt abdominal trauma.[9] There is no consensus regarding NOM for hemodynamically unstable patients who have a hollow viscus injury and active bleeding. Few reports on this approach in similar patients exist.

Our patient was hemodynamically unstable and CT showed contrast extravasation, whereas there were no obvious findings requiring other surgical intervention. We assessed that the hemorrhage could be controlled using IVR because the main cause of hemorrhage was arterial, and the arteries could be occluded immediately without ischemia with super-selective embolization. Therefore, we decided on the best possible manner as above.

Regarding arterial embolization in trauma, the following embolic materials are available: gelatin sponge particles, microcoils, and 15 n-butyl cyanoacrylate. However, there is no consensus for the usage of such materials.[10] Gelatin sponge particles have mainly been used. However, in the following cases, microcoils or 15 n-butyl cyanoacrylate have been used or added following primary doctor judgment: when the target artery is not an end artery, when the target is an aneurysm, or when the patient also has coagulopathy.

We propose that this treatment strategy should be assessed as a first-line treatment. However, it is challenging to perform successfully. Using this case, we assessed that optimal patient selection, immediate and seamless treatment without blood coagulopathy, and managing complications are essential for success. Although the optimal treatment approach for such patients remains unclear, this is an important issue that should be resolved in the future. Therefore, it is necessary to accumulate cases of similar patients for further studies and to assess the validity of this treatment approach.

Conclusion

Currently, hemorrhage control using IVR should be assessed as a first-line treatment, even in hemodynamically unstable patients who have a hollow viscus injury with active bleeding, without obvious findings that indicate surgical repair. However, optimal trauma management is essential for success.

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Ethical approval

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Informed consent

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ORCID iD

Hiroyuki Otsuka https://orcid.org/0000-0002-5869-9569

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