

Successful TAE after DCS for Active Arterial Bleeding from Blunt Hepatic Injury in a Child: A Case Report

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Transcatheter arterial embolization (TAE) for blunt hepatic injury in children is not common and is especially rare after damage control surgery (DCS). We report a successful TAE after DCS on a child for massive bleeding from the left hepatic artery due to a motor vehicle accident. The car (a sport utility vehicle) ran over the chest and abdomen of a 4-year-old boy. On arrival, initial vital signs were as follows: blood pressure, 70/40 mmHg; heart rate, 149/min; temperature, 36.7°C; respiratory rate, 38/min. After resuscitation, computed tomography was done, and a suspicious contrast leakage from a branch of the left hepatic artery and a spleen injury (grade V) were found. TAE was performed successfully after DCS for a liver injury. [J Trauma Inj 2016; 29: 47-50]

Key Words: Embolization, Damage control surgery, Massive bleeding, Hepatic artery, Child

I. Introduction

According to data released by Statistics Korea, motor vehicle accidents ranked second among the causes of death for children aged < 10 year as of 2014.(1) Motor vehicle accidents often cause blunt injury, which leads to multiple internal injuries. The liver and spleen are most frequently affected by blunt abdominal trauma. Up until recently, surgical intervention was the first choice to treat liver injury. Too long time of operation for definite correction, it led to a high mortality rate because it caused patients to experience hypothermia and coagulopathy. Recently, a diversity of treatment methods, such as transcatheter arterial embolization (TAE) and damage control surgery (DCS), which

involves gauze packing, have been used.(2) TAE is reportedly a safe method for children as well.(3)

We aim to report a case of successful treatment using TAE, followed by DCS in a patient with multiple traumatic injuries accompanied by liver damage.

II. Case

A 4-year-old boy, who had his chest and abdomen run over twice by a sport utility vehicle while playing in an apartment complex, was transferred to the emergency room of our hospital from that of another hospital. At presentation, he was in an unstable state with the following vital signs: blood pressure, 70/40 mmHg, pulse, 149/min, respiratory rate, 38/min, temperature 36.7°C, and oxygen saturation,

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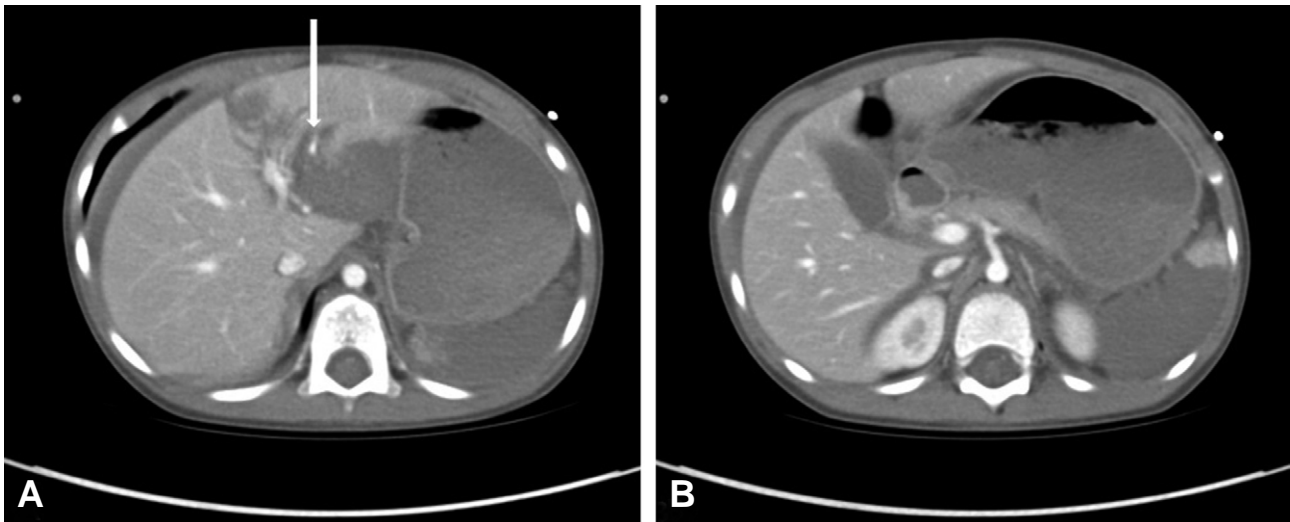


Fig. 1. (A) Contrast enhanced abdominal computed tomography shows extravasation from the branch of left hepatic artery (arrow) and (B) spleen injury (Grade V).



Fig. 2. Hepatic angiography shows brisk extravasation from the branch of left hepatic artery (arrow).

100%. Initial blood test showed a decrease in hemoglobin level to 8.9 g/dL and arterial blood gas analyses found acidosis with pH of 7.295. Liver function testing led to a suspicion of liver injury, because AST/ALT levels were elevated to 1047/533 IU/L. Fluid resuscitation raised blood pressure to 110/70 mmHg and contrast-enhanced computed tomography (CT) was implemented for general examination of the chest and abdomen. Abdominal CT found a spleen injury (grade V) and the liver injury (grade III), which led to a suspicion of the left hepatic artery injury (Fig. 1), and thoracic CT found bilateral pneumothora, multiple rib fractures, and bilateral lung contusion. Endotracheal intuba-

tion was performed due to his decreased consciousness and bilateral closed thoracostomy was performed for bilateral pneumothora. After image study, blood pressure decreased below 90 mmHg again and did not rise over 90 mmHg despite of resuscitation. We decided to perform an emergency operation. An interventional radiology team assisted with TAE for left hepatic artery injury immediately postoperatively. An emergency operation was performed for splenectomy and temporary abdominal closure (TAC), and intra-abdominal gauze packing was performed due to the excessive loss of blood, implying arterial bleeding posterior to the liver. Immediately postoperatively, the patient was transferred to an intervention room for angiography, which revealed active contrast extravasation from a branch of the left hepatic artery (Fig. 2); thus, we performed embolization with a microcoil and gelfoam slurry (Fig. 3, 4) and gave him intensive care in an intensive care unit. At 41 h postoperatively, the second operation was performed as his vital signs became stable and no bleeding tendency was observed. The gauze for intra-abdominal packing was entirely removed, and cessation of bleeding was confirmed prior to abdominal wall repair.

III. Discussion

A motor vehicle accident may cause multiple injuries in children. The spleen and liver are the



Fig. 3. Embolization with coil and gelfoam slurry at the branch of left hepatic artery

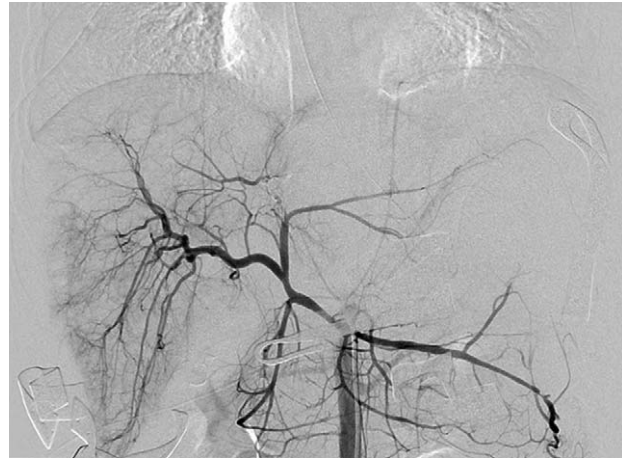


Fig. 4. Post-embolization angiography shows no further active bleeding.

most frequently damaged intra-abdominal organs. (2,4) Up until recently, surgical treatment was mainly performed for liver or spleen injury; however, non-surgical treatment has recently been on the rise due to improved diagnostic technology as well as the improvement in radiologic intervention, including TAE.(2,5,6)

Wars such as the Second World War and Iraq War have changed the concept of trauma treatment. Damage control surgery arose from first-aid techniques that enabled the U.S. navy to endure until a damaged warship sailed back to the base for fundamental repair. Damage control can be divided into three stages: the first stage involves bleeding control using ligation and suture, elimination of intra-abdominal contamination, gauze packing, and TAC; during the second stage, an attempt is made to raise the patient's body temperature to normal levels, assist breathing with mechanical ventilation, correct coagulopathy, give hemodynamic stability, and identify additional damage; and the third stage involves removal of the gauze and definitive treatment, such as restoration of organ continuity.(7) This method can reduce the mortality rate for trauma patients because it helps recover the physiological status.(8-10)

In this case, the patient was in an unstable state hemodynamically, splenectomy was indicated for the spleen injury and it was difficult to control hemorrhage without hepatotomy or resection of the left lobe due to major active bleeding posterior to the

liver. The likelihood of bleeding being caused by the hepatic vein injury couldn't be excluded because significant bleeding was still observed. The Pringle maneuver decreased the amount of bleeding in this case; therefore, we asked the intervention team to prepare for TAE intra-operatively; we performed gauze packing around the liver and in the region of splenectomy, performed TAC, and then immediately performed angiography and embolization. The patient was given 7 U of packed red blood cells, 8 U of fresh frozen plasma, and 12 U of platelets to maintain normal vital signs within 24 h after presentation. Considering that he weighed 17.5 kg, it corresponded to massive transfusion. Because hemostasis using hepatotomy or partial hepatectomy would have aggravated his condition due to excessive bleeding and a long duration of surgery, we believe that TAE with a shorter duration of surgery to preserve physiologic functions is a safer treatment option.

The second operation for removing the gauze and for anatomical reconstruction following DCS may be performed after abnormal temperature, coagulopathy, and acidosis are corrected 24 to 48 h after the first operation.(6) Morris et al.(7) suggested that reconstructive surgery should be performed within 36 h after DCS in most cases, however, reported that the term reduced to 26 h on average during the last 18 months of their research. In our case, the second surgery was performed 41 h after the first one because the patient recovered his physiological

functions after getting intensive care. In the second operation, bleeding was not observed after removing the gauze and abdominal wall repair was performed following peritoneal irrigation.

It is still difficult to choose a method of treating multiple traumatic abdominal organ injuries. We suggest that when a child with liver injury has another abdominal organ injury, which requires surgical treatment, a proper combination of DCS and TAE can be a good treatment option.

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