Case Report

Transcatheter Arterial Embolization for Intramammary Hemorrhage Caused by a Seat Belt Injury: Case Series Including Experience with N-butyl-2-cyanoacrylate

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Abstract

In this study, we report two cases of transcatheter arterial embolization for intramammary hemorrhage caused by seat belt injuries. All patients were female drivers involved in traffic accidents. In each case, we accessed the hemorrhage through the left brachial artery and embolized the perforating branch of the left internal mammary artery with N-butyl-2-cyanoacrylate, obtaining effective hemostasis. Transcatheter arterial embolization is considered effective for breast hemorrhage because of rare but dangerous seat belt injuries.

Key words: intramammary hemorrhage, TAE, NBCA, N-butyl-2-cyanoacrylate, seat belt

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Introduction

Although seat belts have reduced the number of fatalities in traffic accidents, seat belts are also known to cause injuries [1]. Seat belt-induced injury of the breast is also known to rarely occur, and it may result in shock and even death [2, 3]. Majeski [2] proposed a classification system that can be used to establish a management policy for seat belt injury of the breast; however, the most effective intervention method has not been established. Transcatheter arterial embolization (TAE) has also been discussed as a treatment option [2], but it is reported even less frequently [4, 5]. In this study, we report two cases of seat belt-induced trauma to the breast treated with TAE, all of which resulted in hemostasis.

Case Reports

Case 1

A 60-year-old woman was driving a car when it collided with a truck. Her left chest showed a seat belt scar and subcutaneous hematoma, and her right breast had been surgically removed for treatment of breast cancer. Her blood pressure was 121/61 mmHg, and her pulse was 87 beats per minute. Dynamic contrast-enhanced computed tomography (CT) showed a left breast hematoma with active arterial extravasation of contrast media from the perforating branch of the left internal mammary artery (IMA) (**Fig. 1**). Compression hemostasis with a breast band was initially attempted, but her blood pressure decreased 4 hours later, and we decided to perform TAE.

A 4-French sheath was inserted into the left brachial artery, and a 4-French catheter (IMA type; Goodman, Nagoya, Japan) was introduced to the left IMA. Angiography of the

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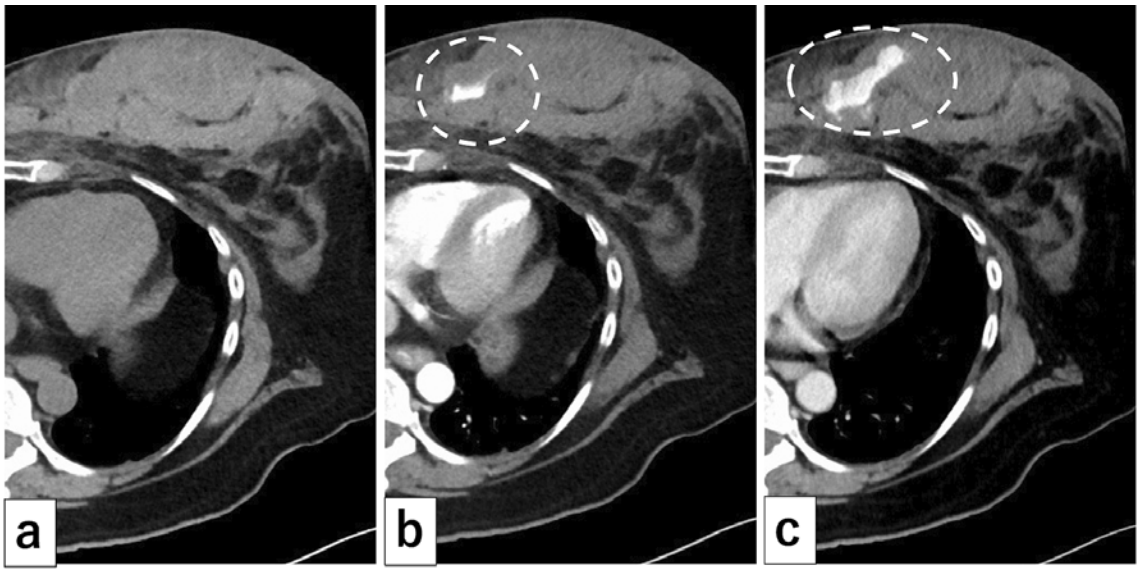

Figure 1. Dynamic contrast-enhanced computed tomography images in Case 1. (a) Plain image, (b) arterial-phase image, and (c) venous-phase image are shown. Contrast leakage (broken circles) extends from (b) to (c).

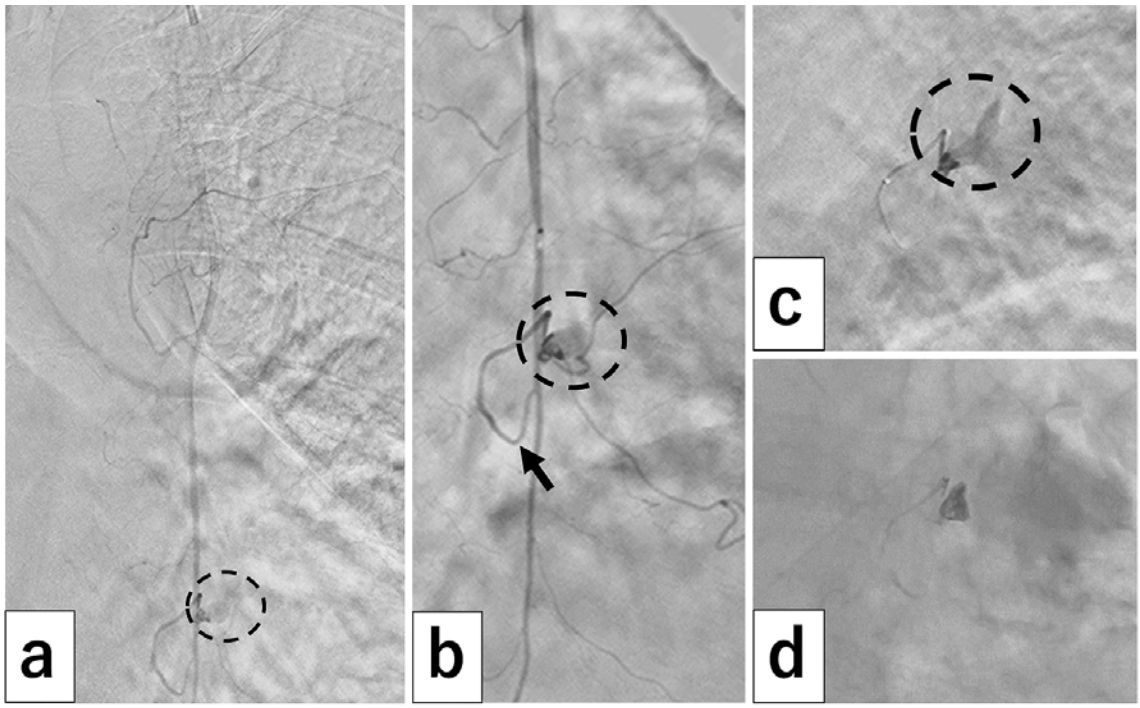

Figure 2. Angiography of the left internal mammary artery in Case 1. Contrast leakage (broken circles) was observed from a perforating branch (arrow). (c) The branch was selected by a microcatheter. (d) The cast of N-butyl-2-cyanoacrylate after embolization is shown.

IMA showed extravasation from a perforating branch (**Fig. 2**). A 4-French straight catheter (GLIDECATH II, TERUMO, Tokyo, Japan) was advanced into the IMA using the catheter exchange technique. A 1.7-French microcatheter (ASAHI Veloute; ASAHI Intecc, Tokyo, Japan) was advanced to the branch. In selecting embolizing materials, we believed that a metal coil or gelatin sponge would result in proximal embolization because the bleeding point was peripheral to the IMA branch, which the microcatheter could not reach. Therefore, N-butyl-2-cyanoacrylate (NBCA) (Histoacryl; B. Braun, Melsungen, Germany) mixed with Lipiodol (Guerbet, Villepinte, France) at a ratio of 1:4 was injected. After embolization, the extravascular leak disappeared and the patient's blood pressure increased. The patient was discharged on the sixth day after admission and followed up for 3 months. During follow-up, no adverse

events such as mammary necrosis, fat necrosis, skin disorders, or abscess formation due to NBCA injection were observed.

Case 2

A 60-year-old female driver was involved in an accident in which she rear-ended a utility pole. Her left chest showed a seat belt scar, purpura, and subcutaneous hematoma. Her blood pressure was 145/98 mmHg, and her pulse was 111 beats per minute. One hour after arrival at the emergency room, blisters appeared on her left breast and were believed to be a sign of compartment syndrome because of increased intramammary pressure (**Fig. 3**). Dynamic contrast-enhanced CT showed a left breast hematoma with active arterial extravasation of contrast media (**Fig. 4**). Given the premise of surgical hematoma removal for compartment syndrome, we radiologists and breast surgeons discussed hemostasis options. We considered the possibility that surgical hemostasis with breast conservation would be difficult versus hemostasis with TAE, and given that TAE could be initiated more quickly, we decided to perform TAE first. A 4-French sheath was inserted into the left brachial artery, and a 4-French catheter (IMA type; Goodman) was introduced to the left IMA. Angiography of the IMA showed extravasation from a perforating branch (**Fig. 5**). A 4-French straight catheter (GLIDECATH II, TERUMO) was advanced into the IMA using the catheter exchange technique. A 1.7-French microcatheter (ASAHI Veloute, ASAHI Intecc) was advanced to the branch, and NBCA mixed with Lipiodol at a ratio of 1:4 was injected. After embolization, the extravascular leak disappeared. On the next day, however, the blister on the left breast increased and the pain worsened; therefore, a hematoma removal procedure was performed under local anesthesia. The patient underwent fixation of a rib fracture on the third day and embolization of a carotid-cavernous sinus fistula on the 17th day, and she was discharged on the 36th day. The patient was then followed up for 3 months, and no adverse events due to NBCA injection were observed.

Figure 3. Photograph of the chest of the patient in Case 2. Subcutaneous hemorrhage and purpura of the left breast, seat belt scars (arrowhead), and blisters (broken circle) are shown.

Discussion

Although seat belt injuries are common, intramammary hemorrhage is rare, and no treatment strategy has been established. In Japan, for example, conservative treatment, surgery, and TAE have been reported in patients with and without shock [3,5,6]. Intramammary bleeding can cause shock and compartment syndrome as in previous cases and in cases of the present report, and active bleeding as described in the classification established by Majeski [2] should be

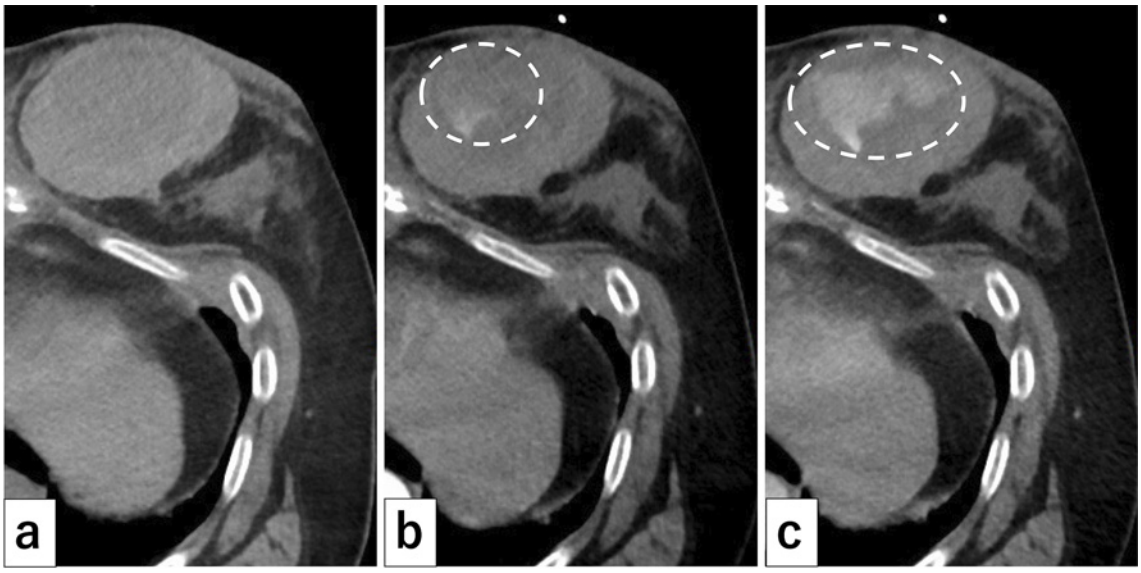

Figure 4. Dynamic contrast-enhanced computed tomography images in Case 2. (a) Plain image, (b) arterial-phase image, and (c) venous-phase image are shown. Contrast leakage (broken circles) extends from (b) to (c).

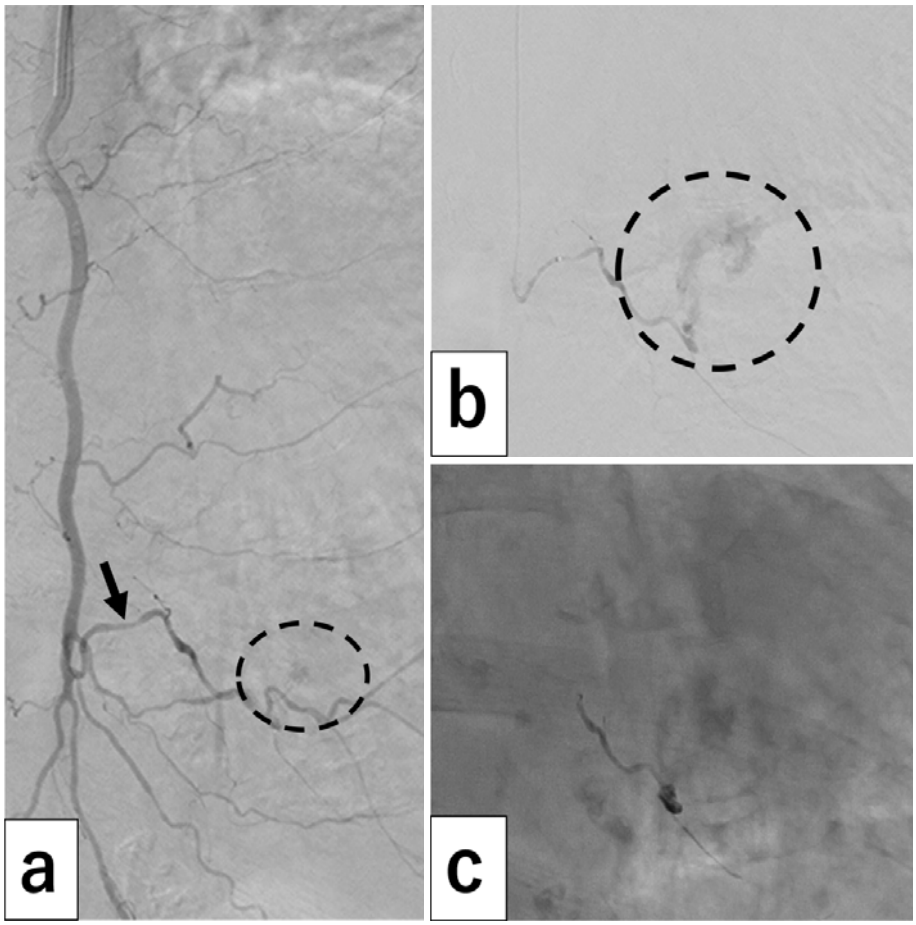

Figure 5. Angiography of the left internal mammary artery in Case 2. (a) Contrast leakage (broken circles) was observed from a perforating branch (arrow). (b) The branch was selected by a microcatheter. The catheter reached a site near the hemorrhage (broken circle). (c) The cast of N-butyl-2-cyanoacrylate after embolization is shown.

considered for aggressive therapeutic intervention. In this classification, Majeski [2] recommended either surgery or embolization for active bleeding; however, there are few reports of embolization. Hemostasis was successfully achieved in all two of our patients, and we believe that TAE is effective. However, in Case 2, in which the patient had compartment syndrome, surgical hematoma removal was necessary after hemostasis.

Previous reports on embolic materials have described the use of coils and gelatin sponges. However, coils may not be able to cross the perforator bend, as reported by Matsumoto et al. [5]. With the use of NBCA, as in our cases, embolization can be performed if the microcatheter can reach the perforating branch. Additionally, there are no restrictions on the inner diameter of the microcatheter for NBCA embolization compared with coils. In our cases, embolization was achieved without any adverse events, and we consider NBCA to be an effective embolizing agent for breast hemorrhage.

Regarding the embolization site, Myhre et al. [4] embolized both the main trunk of the IMA and the peripheral perforating branch, whereas in all two of our cases, effective hemostasis was achieved by embolizing the perforating branch only. This implies that peripheral embolization alone is sufficient if a perforating branch can be selected.

In conclusion, intramammary bleeding due to a seat belt injury is rare but should be aggressively stopped, and TAE is considered an effective means. Peripheral embolization with NBCA may also be effective and safe.

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Conflict of Interest: None

Author Contribution: Y.K. was mainly involved in drafting the manuscript and creating figures. K.M. was involved in the intervention of all cases and in drafting the manuscript. R.N., M.K., and M.T. were involved in drafting the manuscript. H.D., H.A., and J.S. critically revised the entire manuscript. K.M., A.Y., and M.A. provided patient care as surgeons. M.A. also created figures. All authors reviewed the manuscript.

Patient Consent Statement: This study was approved by the Ethics Committee of our institution.

Informed consent was obtained for the case report to be published.

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