CT findings of incarcerated double loop hernia.

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Authors: J. Miyaji, T. Katayama, A. Uchida, M. Sato, E. Yamazaki; TOKYO/JP
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Learning objectives

1) To understand the condition of double loop hernia from a series of 10 cases.

2) Usefulness of evaluation of mesentery in double loop hernia.
**Background**

A double loop hernia, also known as Maydl's hernia, hernia-in-W, or retrograde hernia, consists of 2 loops within a hernia sac, with an intra-abdominal loop existing between the 2 loops (1-5). The intra-abdominal loop has been reported to be the most common location for strangulation (1). However, such cases have not been sufficiently evaluated using computed tomography (CT). We studied the mechanism responsible for a double loop hernia and determined that the most common location of strangulation was at some point along the three loops, including the intra-abdominal loop, based on careful observations of the mesentery.
Findings and procedure details

Patients: We reviewed CT findings for incarcerated hernias, consisting of 2 loops of the small intestine or colon within a hernia sac, treated during a 5-year period between 2011 and 2015 at 2 facilities. Ten cases were enrolled in this study (7 cases of inguinal hernia and 3 cases of abdominal incisional hernia).

Methods: In each case, the location of the hernia, the hernia contents, the degree of strangulation of the intra-abdominal loop, the complications, and the type of intra-abdominal loop were evaluated based on CT findings. The type of intra-abdominal loop was defined as follows: Type A, all parts of the mesentery of the intra-abdominal loop pass through the hernia orifice; or Type B, only a part of the mesentery of the intra-abdominal loop passes through the hernia orifice (Figure 1).

The CT findings were determined based on the consensus of 3 radiologists. The degree of strangulation was determined based on CT findings showing intestinal edema and mesenteric edema and was classified into 3 categories (none, mild, or strong; Figure 2). Though intestinal dilatation reflects an obstructive change, it is not a direct indicator of ischemic change. Thus, we did not consider the degree of intestinal dilatation when categorizing the hernias in this study. Since the state of the hernia can change between the CT examination and surgery, we used the CT findings, rather than the operative findings, when evaluating the degree of edema. We examined the condition of the incarcerated double loop hernia as well as the usefulness of evaluating the mesentery in double loop hernias.

Figure 1. Type of intra-abdominal mesentery. a (Type A): all parts of the mesentery of the intra-abdominal loop pass through the hernia orifice.

b (Type B): only part of the mesentery of the intra-abdominal loop passes through the hernia orifice.

Figure 2. Three categories of degree of strangulation. a: None, attenuation of the affected right mesentery is equal to that of the normal left mesentery. b: Mild, attenuation of the affected right mesentery is slightly higher than that of the normal left mesentery. c: Strong, attenuation of the affected medial mesentery is obviously higher than that of the normal right mesentery. Intestinal mural edema is also visible.

In this study, incarceration means an obstruction and strangulation means an abnormality of perfusion or ischemia.
Results

Table 1: Conditions of double loop hernias and treatment

There were 7 cases of inguinal hernia and 3 cases of abdominal incisional hernia. Both sites tended to have a large hernia orifice, and the actual hernia orifice was large in all the cases. Conservative treatment was performed in 50% (5/10) of the cases. In Case Nos. 1, 2, and 9, the intra-abdominal mesentery was type A and edema of the intra-abdominal loop was observed. However, in cases with type B, edema of the intra-abdominal loop was graded as none or mild. No other findings suggesting severe ischemia, such as poor contrast enhancement, mural hyperdensity, pneumatisosis intestinalis, or portal gas, were observed (Table 1).

Cases

Cases 1, 2, and 9 (Type A intra-abdominal mesentery)

Case 1: A 76-year-old man consulted our institute because of a right inguinal hernia and abdominal pain. CT findings showed an incarcerated right inguinal double loop hernia. Edema was most severe in the intra-abdominal loop. Edema in the 1st loop and the 2nd loop was also seen. There was a small amount of ascites in the hernia sac (Figure 3). Manual reduction and elective surgery were performed. The surgical findings showed a right direct inguinal hernia and a small amount of hemorrhagic ascites inside the hernia sack. The intestine had adhered to the hernia sac near the inguinal canal. Necrosis was not observed.

Figure 3. Non-enhanced CT image obtained in case 1. An incarcerated right inguinal double loop hernia is visible. a: Edema of the intestine and mesentery was most severe in the intra-abdominal loop (arrow). b: Edema in the 1st loop (arrow) and the 2nd loop (arrowhead) was also seen. There was a small amount of ascites in the hernia sac.

Case 2: A 61-year-old man was admitted by ambulance because of a left inguinal hernia and abdominal pain. CT findings showed an incarcerated left inguinal double loop hernia. The intestinal and mesenteric edema was severe in the 1st loop, the 2nd loop, and the intra-abdominal loop (Figure 4). Emergency surgery without a bowel resection was performed. The surgical findings showed an indirect hernia containing the small intestine. The mesentery inside the hernia sack was edematous, and hematomas several millimeters in size were observed all over the mesentery, but no signs of necrosis were seen.

Figure 4. Non-enhanced CT image obtained in case 2. An incarcerated left inguinal double loop hernia is visible. The intestinal and mesenteric edema was severe in the
intra-abdominal loop (a) as well as the 1st and 2nd loops (b). In this case, the 1st loop was difficult to distinguish from the 2nd loop on the CT images.

Case 9: A 79-year-old man was admitted by ambulance because of a right inguinal swelling and abdominal pain. CT findings showed an incarcerated right inguinal double loop hernia. The intestinal and mesenteric edema was severe in the intra-abdominal loop, as well as the 1st and 2nd loops (Figure 5). No treatment was performed, and the patient improved spontaneously.

Figure 5. Non-enhanced CT image obtained in case 9. An incarcerated right inguinal double loop hernia is visible. The intestinal and mesenteric edema was severe in the intra-abdominal loop (a), the 1st loop (b, c: arrow), and the 2nd loop (b: arrowhead).

Cases 3-8 and 10 (Type B intra-abdominal mesentery)

Case 3: A 65-year-old man was admitted to our institute because of a right inguinal hernia and acute abdominal pain. CT findings showed an incarcerated right inguinal double loop hernia. Mild strangulation was seen in the 1st and 2nd loops, but was absent in the intra-abdominal loop. (Figure 6). An emergency surgery without a bowel resection was performed. The surgical findings showed the presence of the small intestine within the hernia sack. No signs of necrosis were observed.

Figure 6. Non-enhanced CT image obtained in case 3. An incarcerated right inguinal double loop hernia is visible. Mild strangulation was seen in the 1st and 2nd loops (c) but was absent in the intra-abdominal loop (a, b). The vessels in the intra-abdominal mesentery (a, b: arrow) merged with the other superior mesenteric vessels without passing through the hernia orifice. Thus, the mesentery was categorized as type B.

Case 4: An 82-year-old woman consulted our institute because of an abdominal incisional hernia and abdominal pain. A manual reduction was attempted, but the hernia was irreducible. CT findings showed an incarcerated abdominal incisional double loop hernia at the median abdominal wall. A protrusion of the hernia sac in which the 2nd loop was incarcerated was observed on the right side of the hernia sac. Mild strangulation of the intra-abdominal mesentery was seen. An emergency surgery without a bowel resection was performed. The surgical findings showed the presence of the small intestine inside the hernia sack and a small amount of serous ascites inside the hernia sack. The morphology of the hernia was the same as that observed using CT. The intestinal color was almost normal.

Figure 7. Non-enhanced CT image obtained in case 4. An incarcerated abdominal incisional double loop hernia was observed in the median abdominal wall. A protrusion of
the hernia sac in which the 2nd loop was incarcerated was observed on the right side of the hernia sac (a: arrowhead). The 1st loop was located in the left part of the hernia sac (a: arrow). The vessels in the intra-abdominal mesentery (b: arrow) were merged with the other superior mesenteric vessels without passing through the hernia orifice. Mild strangulation was seen in the intra-abdominal mesentery (c: arrow). CT was performed before manual reduction in this case. The small intestine formed a closed-loop in the hernia sac, based on in the CT findings (d: arrow). The shape of the hernia changed to a W loop hernia, as observed using CT, after manual reduction. (e: arrow). The manual reduction may have affected this change.

Case 5: A 94-year-old man consulted our institute because of an abdominal incisional hernia and abdominal pain. CT findings showed an incarcerated incisional double loop hernia in the lower right paramedian abdominal wall. Mild strangulation of the intra-abdominal mesentery was seen. However, the degree of strangulation was difficult to evaluate because of the presence of ascites (Figure 8). Manual reduction and an elective hernioplasty were performed. No ischemic changes were observed during the surgery.

Figure 8. Contrast-enhanced CT image obtained in case 5. An incarcerated incisional double loop hernia is visible in the lower right paramedian abdominal wall. Mild strangulation of the intra-abdominal mesentery was seen (a, b: arrowhead). However, the degree of strangulation of the intra-abdominal mesentery was difficult to evaluate because of the presence of ascites. The presence of edema in the 1st loop (a: arrow) and the 2nd loop (b: arrow) was unclear. Ascites inside the hernia sac was seen (a, b).

Case 6: A 90-year-old man consulted our institute because of a left inguinal hernia and abdominal pain. CT findings showed an incarcerated incisional double loop hernia in the lower median abdominal wall. Strangulation was severe in the 1st loop and mild in the 2nd loop, but was absent in the intra-abdominal loop (Figure 9). An emergency surgery without a bowel resection was performed. The surgical findings showed that the intestine at a point located 150 cm from the Treitz’ ligament (1st loop) had become incarcerated; an ischemic color change was observed but was considered to be reversible and was left as it was. The 1st loop was thought to be primarily responsible for the symptoms and the 2nd loop was thought to have existed prior to the presently reported episode.

Figure 9. Contrast-enhanced CT image obtained in case 6. An incarcerated incisional double loop hernia was seen in the lower median abdominal wall. Severe edema at the intestinal wall of the 1st loop was also seen. Ascites in the hernia sac was visible near the 1st loop (arrow). Mild edema was seen in the 2nd loop (arrowhead), but was absent in the intra-abdominal loop (circle).
Case 7: An 80-year-old woman consulted our institute because of a left inguinal hernia and abdominal pain. CT findings showed the small intestine and sigmoid colon inside the hernia sac. Incarceration had occurred at the small intestine. The hernia of the sigmoid colon was thought to have existed spontaneously and did not contribute to the ileus. The region from the ascending colon through to the descending colon was normal (Figure 10). Manual reduction and elective surgery were performed. The surgical findings showed no signs of necrosis.

Figure 10. Contrast-enhanced CT image obtained in case 7. The small intestine (b: arrow) and sigmoid colon (b: arrowhead) were visible inside the left inguinal hernia sac. Incarceration had occurred at the small intestine. The hernia of the sigmoid colon was thought to have occurred spontaneously and did not contribute to the ileus. The region from the ascending colon through to the descending colon was normal.

Case 8: A 76-year-old woman was transported from another hospital because of a right inguinal hernia and abdominal pain. CT findings showed an incarcerated right inguinal double loop hernia. A perforation was seen on the oral side of the 1st loop. An adynamic ileus caused by peritonitis was present (Figure 11). An emergency surgery with a bowel resection was performed. The surgical findings revealed a perforation of the intestine located 120 cm from the end of the ileocecum in the hernia sac. (which was different from the CT findings, possibly because the location may have changed during the period between the CT examination and surgery). Strong adhesion of the intestine and mesentery was present in the area 50-60 cm around the intestinal perforation. The long-term presence of the hernia was thought to have caused the adhesions. An intestinal lump containing adhesions was surgically removed.

Figure 11. Contrast-enhanced CT image obtained in case 8. An incarcerated right inguinal double loop hernia is visible. A perforation (b: arrow) was found on the oral side of the 1st loop (c: arrow). An adynamic ileus caused by peritonitis was present. Because of the peritonitis, diffuse hyperattenuation of the mesenteric fat was present.

Case 10: A 75-year-old woman who had no subjective symptoms but in whom an incarcerated left inguinal hernia was incidentally found on a CT examination for an evaluation of the response to therapy against sigmoid colon cancer was treated. CT findings showed an incarcerated right inguinal double loop hernia. Intestinal edema was seen in the 1st loop and the 2nd loop, but was absent in the intra-abdominal loop (Figure 12). No treatment was performed, and the patient recovered spontaneously.

Figure 12. Contrast-enhanced CT image obtained in case 10. An incarcerated right inguinal double loop hernia is visible. Edema was present at the intestine and mesentery
of the 1st loop (b: arrow). At the 2nd loop, intestinal edema was present, but the possible presence of mesenteric edema was unclear (b: arrowhead). No edema at the intra-abdominal loop was seen (circle).

Discussion

Double loop hernia is a rare variety (<2%) of strangulated hernia in surgical findings (1,3). However, some cases of double loop hernia were treated conservatively in this study, so the frequency of double loop hernia may be more than 2%.

According to past studies, double loop hernia occurs as a result of a multitude of factors. Long standing hernias may predispose an individual to more of the intestine being dragged into the hernia sac. Adhesion of the intestines may also predispose individuals to a W configuration, since the intestine around the sac tends to become incarcerated in the hernia sac (1,4).

In case 4 of the present series, the shape of the hernia initially appeared to be a single loop but subsequently changed to a double-loop hernia. This change was thought to have occurred as a result of the sliding of the small intestine. Therefore, one of the mechanisms for a double loop hernia could be sliding of the intestine. Sliding of the intestine was also seen in case 8, in which the position of the intestine changed between the emergency surgery and the CT examination. In case 7, two different loops independently protruded into the hernia sac. Thus, more than one mechanism for the formation of a double loop hernia is likely.

Double loop hernias usually have a large hernia orifice. Inguinal hernias and incisional hernias tend to have a large hernia orifice (2). In addition, they are sometimes left untreated, and the orifice can increase in size (1,3). Consequently, these hernias are often treated by manual reduction, and surgery is not necessarily performed (1,3). Thus, it is useful to diagnose whether a double loop hernia is present and to determine the degree of strangulation using CT. The intra-abdominal loop has been reported to be the most common location for strangulation (1,4,5). In the present study, this was true in cases with a type A intra-abdominal mesentery. However, this finding was not true for cases with a type B intra-abdominal mesentery. The reason for this is probably that perfusion of the intra-abdominal loop was preserved by the blood vessels that do not pass through the hernia orifice in the type B cases. Thus, careful interpretation of the CT findings for the mesentery of the intra-abdominal loop is important.
Images for this section:

Fig. 2: figure 1-1

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**Fig. 1:** figure 1-2

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* The region from the descending colon to the ascending colon between the 1st loop and the 2nd loop was normal.
** Diffuse hyperattenuation of the mesentery caused by peritonitis was observed.

No significant findings were seen in the intra-abdominal loop, compared with the other mesentery.

List of abbreviations
S: small intestine; rt. right; lt. left; CT: computer tomography; NECT: Non-contrast-enhanced CT; CECT: contrast-enhanced CT; M: men; F: female
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Fig. 9: figure 4-2

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Fig. 11: figure 5-2

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Fig. 29: figure 11-3

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Fig. 30: figure 12-1

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Fig. 31: figure 12-2

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Conclusion

Double loop hernias usually have a large hernia orifice (1,3) and are often treated by manual reduction, resulting in strangulated loops being left in the abdomen (5). Visualization of all the loops, including the intra-abdominal mesentery, using CT may be useful for evaluating double loop hernias.
References


