RELEVANT RADIOLOGICAL FINDINGS FOR THE DIAGNOSIS OF NECROTIZING ENTEROCOLITIS AND ITS COMPLICATIONS*

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Abstract Necrotizing enterocolitis is one of the most frequent and severe gastrointestinal emergencies occurring in the neonatal period. Once necrotizing enterocolitis is suspected a simple abdominal x-ray is a routine examination and this film will play an essential role in the diagnosis of the disease and the follow-up care of the patient, as well as in the detection of complications. In the present study we reviewed the pertinent literature and described the radiological findings, illustrated with cases from our institution. We concluded that the radiological diagnosis of necrotizing enterocolitis done at all stages contributes for an immediate therapeutic management, reducing the complications and improving the patient’s survival.

Keywords: Necrotizing enterocolitis; Newborn; Radiological diagnosis.

INTRODUCTION

Necrotizing enterocolitis (NEC) represents a condition whose etiology still remains unclear, predominantly affecting neonates (NN) weighing less than 1,500 g, and is one of the most frequent and severe gastrointestinal emergencies occurring in the neonatal period⁴⁻⁵.

Most frequently accepted etiological factors for explaining this condition are intestinal ischemia, resulting in alterations of the intestinal mucosa, excessive bacterial growth with formation of gas in the intestinal wall, and persistent intestinal irritation because of oral feeding. The most suggestive clinical findings of this disease are abdominal distension, food or bilious emesis and presence of blood in stools²⁻³.

The abdominal plain x-ray is a routine procedure in NN with NEC, since it plays an essential role in the diagnosis, follow-up and detection of complications indicating the need for surgery. During the treatment, NN should undergo serial plain x-rays every hour to allow the early diagnosis of complications⁴⁻⁵.

RADIOLOGICAL ALTERATIONS

1 – Generalized intestinal distension

The earliest radiological alteration in NEC is a diffused and persistent intestinal gas distension⁶. Radiologically, an intestinal loop may be considered as dilated when its measure surpasses the width of the first lumbar vertebral body⁶⁻⁷. This may be a non-specific radiological finding in NN with other abnormalities, especially those under continuous ventilation by positive pressure⁸. Nevertheless, the suspect of NEC should be always raised in radiological of NN presenting with persistent, generalized intestinal distension and characteristic clinical picture⁹⁻¹⁰ (Figure 1).

2 – Localized distension of an intestinal loop

Localized distension of an intestinal loop presenting a tubular configuration and thickened walls was initially described as a radiological sign of imminent perforation. Currently, this radiological sign has not been considered as an imminent risk of perforation anymore, although it is useful to raise the suspicion of NEC at its early phase, since this may mean loop distress⁹⁻¹⁰ (Figure 2).

3 – Intestinal pneumatosis

Pneumatosis means presence of gas in the intestinal wall, representing a complication from necrotizing enterocolitis. Although there is also a destruction of the intestinal mucosa, the presence of intramural gas is considered as a consequence of an excessive bacterial increase with gas passage from the intestinal lumen into the loop wall. The gas may be in the stomach and intestine walls, but predominates in the large intestine wall¹¹.
Intestinal pneumatosis represents the most pathognomonic radiological finding of NEC, presenting as visible radiolucent, linear, curved-linear or bullous images on the intestinal loop wall. In some circumstances, the radiological appearance resembles the intestinal fecal contents, and the diagnosis is made by means of serial x-rays demonstrating the permanence of intramural gas, contrarily to the feces with present motility\(^{(2,11-13)}\) (Figure 3A–E).

4 – Air within the portal system

The intestinal pneumatosis may extend into the venous portal system, and is visible on abdominal plain x-ray films as radiolucent, linear images in hepatic projection, and extending to peripheral areas\(^{(6,11,14,15)}\) (Figures 4A and 4B). This type of distribution allows the differential diagnosis with air in the biliary tract, with a radiological aspect similar to that of air within
Relevant radiological findings in necrotizing enterocolitis

5 – Pneumoperitoneum

The term pneumoperitoneum refers to the presence of free air within the peritoneal cavity caused by a perforated hollow, and is a complication from necrotizing enterocolitis\(^1,2,6,11\). The radiological signs can be seen on abdominal plain x-rays performed in dorsal decubitus, with vertical and horizontal x-ray beams, orthostatic position and left lateral decubitus with horizontal beams\(^{11,16}\).

On x-ray films obtained in dorsal decubitus with vertical x-ray beams a darkened abdominal cavity is observed, and the intestinal wall is visualized because of the presence of air both inside and outside the loop (Figure 5). On this view, a falciform ligament may appear, the association of these images being described as “football sign” for resembling the shape of the ball used in the American football\(^{11}\). On x-ray films obtained with the patients in orthostatic position (Figure 6), dorsal decubitus (Figures 7A and 7B) and left lateral decubitus with horizontal x-ray beam (Figures 8A and 8B), the free air movement is observed within the abdominal cavity, under the diaphragmatic cupula, anteriorly, or between the liver and the right abdominal wall.

6 – Late complications

Areas of stenosis of the large intestine represent a late complication from necrotizing enterocolitis, manifesting clinically through obstruction. On plain abdominal x-ray films, a significant intestinal distension is observed with absence of air in the rectum\(^{17,18}\). The diagnosis is confirmed by opaque enema demonstrating areas of stenosis in the large intestine. In the presence of risk of intestinal rupture, this examination should be performed with diluted iodinated contrast agent\(^{18,19}\) (Figures 9, 10A and 10B).

CONCLUSION

The radiological diagnosis of NEC accomplished in all phases contributes for an immediate therapeutical management, reducing the rate of complications and improving the patients’ survival.
Figure 8(A,B). A: Abdominal x-ray film obtained in left lateral decubitus with horizontal x-ray beams, where pneumoperitoneum is demonstrated between the liver and the right abdominal wall. B: Scheme demonstrating the NN positioning to be adopted for study in left lateral decubitus with horizontal beam to demonstrate pneumoperitoneum (reference 16).

Figure 10(A,B). Anteroposterior (A) and lateral (B) views of opaque enema demonstrating areas of stenosis in the transverse and sigmoid colon.

REFERENCES