Case Report

Non-Rotation of the Midgut in Adults

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Abstract : **Two cases of non-rotation of the midgut were detected in cadaveric bodies from the Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. They were both female, aged 83 and 32, respectively. In both cases, the duodenum, jejunum, ileum, and colon lay in the unrotated position with the small intestine occupying the right half and the large intestine occupying the left half of the abdominal cavity. Additionally, the duodenojejunal junction remained on the right side of the abdomen, whereas the caecum and ascending colon lay in the midline, with the terminal ileum entering the right side of the caecum. The appendix entered the left side of the caecum. Interestingly, they had had no clinical symptoms during life. These abnormalities implied that midgut rotation during embryonic period occurred only as far as 90-degrees counterclockwise instead of the usual 270-degree rotation.**

To our knowledge, this is the first report of asymptomatic non-rotation of the midgut in Thailand. The variation found in the present study provides additional information concerning the variation seen in human anatomy and should be considered in patients with atypical symptoms related to the gastro-intestinal tract.

Key words : Non-Rotation of Midgut, Anomaly of Midgut, Intestine

เรื่องย่อ :

ความผิดปกติของการหมุนของลำไส้ส่วนกลางในผู้ใหญ่

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รายงานความผิดปกติของการหมุนของทางเดินอาหารส่วนกลาง (Midgut) 2 ราย ทั้ง 2 รายนี้พบในศพสำหรับการศึกษาวิชามหกายวิภาคศาสตร์ ในภาควิชากายวิภาคศาสตร์ คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล ทั้ง 2 รายเป็นเพศหญิง อายุ 83 ปี และ 32 ปีตามลำดับ เมื่อเปิดช่องท้องแล้วพบว่าลำไส้เล็กทั้งหมดอยู่ทางขวาของช่องท้องโดยต่อกับลำไส้ใหญ่ซึ่งอยู่ทางซ้ายของช่องท้อง และไม่มีประวัติการเจ็บป่วยเกี่ยวกับระบบทางเดินอาหาร จากการชำแหละตรวจสอบรายละเอียด ตำแหน่งของลำไส้และทบทวนพัฒนาการและการหมุนตัวของทาง

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เดินอาหารในระยะเอ็มบริโอ ความผิดปกตินี้เกิดจากการที่ลำไส้หมุนไปเพียง 90 องศาซึ่งปกติควรจะหมุนทั้งหมด 270 องศา ในทิศทางทวนเข็มนาฬิกา รายงานความผิดปกติของการหมุนของทางเดินอาหารส่วนกลางโดยไม่มีอาการผิดปกติของทั้งสองรายนี้เป็นรายงานแรกที่มี จากความหลากหลายที่พบนี้เป็นข้อมูลเพิ่มเติมที่ต้องคำนึงในการศึกษาเกี่ยวกับกายวิภาคของคนและสามารถใช้เป็นข้อสังเกตโดยเฉพาะในรายที่มีอาการแสดงบ่งชี้ความผิดปกติของทางเดินอาหาร

INTRODUCTION

Non-rotation of the midgut is the term used for an abnormality in intestinal rotation occurring during embryonic development, with the result that the small intestine lies on the right side of the abdomen and the large intestine on the left[1-6]. It is a rare anomaly which may be found alone or may be found in patients with omphalocele, gastroschisis, or a hernia of the foramen of Bochdalek[7-10]. Although the malrotation is generally asymptomatic, complications occur, such as intestinal obstruction (volvulus), infarction or gangrene of the intestine[11,12]. Symptoms may vary from mild to severe. The abnormalities may cause symptoms in the neonatal period. However, the patient may remain asymptomatic into adulthood as in these two cases in the present report.

In order to understand normal intestinal rotation, the embryonic development of the midgut is reviewed as follows (Figure 1); - By the 5th week, the midgut loop is suspended from the dorsal abdominal wall by an elongated mesentery and communicates with the yolk sac by the vitelline duct. The midgut loop and its mesentery elongates rapidly and forms the primary intestinal loop. By the early 6th week, the continuing elongation of the midgut combined with the pressure due to the dramatic growth of the other abdominal organs such as the liver, forces the primary intestinal loop to herniate into the umbilicus, which is called a physiological umbilical hernia. As the primary intestinal loop herniates into the umbilicus, it also rotates around the axis of the superior mesenteric vessels by 90 degrees counterclockwise. Thus, the cranial limb moves to the right side, and the caudal limb moves to the left side. During the 10th week, the herniated midgut loop retracts into the abdominal cavity and rotates counterclockwise through an additional 180 degrees. The final position of the midgut loop is the small intestine occupying the central part of abdomen, with the large intestine occupying the periphery with the ascending colon to the right, and the transverse colon crossing from right to left[1-6].

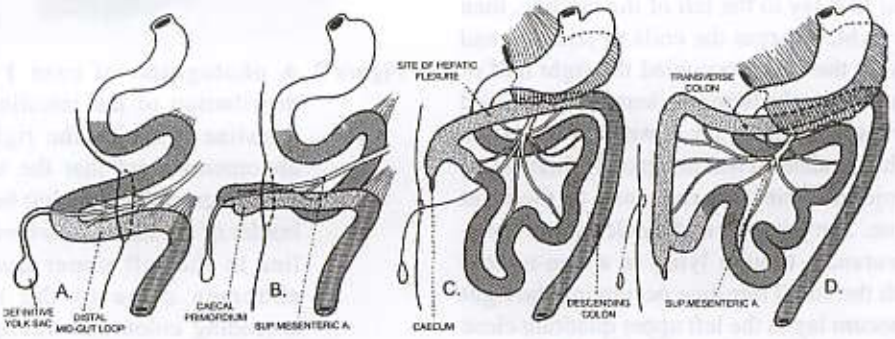

Figure 1. Stages in development and rotation of the midgut. A to D, seen obliquely from the left side. The proximal limb of the midgut is indicated by oblique ruling; the distal limb is stippled.
A, At 5 weeks. **B**, At 7 weeks. **C**, At 12 weeks **D**, Fetal period.

If the midgut loop returns into the abdominal cavity without rotating 180 degrees counterclockwise, the small intestine will occupy the right side, whereas the large intestine will occupy the left side of the abdominal cavity. This abnormality is called non-rotation of the midgut or non-rotation of the intestine[7-12]. However, in the past decades, only two cases of non-rotation of the midgut have been found in the Department of Anatomy in cadavers. The purpose of this report is to describe non-rotation of the midgut in these two adult Thai cadavers in terms of the anatomical position of the small intestine and the large intestine.

CASE REPORT

Two cases of non-rotation of the midgut were found in cadaveric bodies from the Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. They were both female aged 83 and 32 respectively. In both cases, the small intestine occupied the right side of the abdomen while the large intestine occupied the left side. Though they had abnormalities of midgut rotation, these were clinically silent throughout their lifetime. The anatomical features in both cases are described as follows:-

Case 1

On examination, the small intestine in this case occupied the greater part of the abdominal cavity. It extended from the left side of the midline to the right half of the abdomen. On examination, the duodenum at first lay to the left of the midline, then went to the right, whereas the coils of jejunum and the majority of the ileum occupied the right half of the abdomen, except the terminal ileum which passed upwards to the left below the lower border of the stomach. The duodenum was not grossly dilated and the duodenojejunal junction remained to the right of the midline. The jejunum and the ileum were normal in appearance, though lying in a non-rotated position with the small intestine occupying the right half. The caecum lay in the left upper quadrant close to the midline of the abdomen behind the small intestine (Figure 2).

Case 2

The whole midgut derivatives from the duodenum to the transverse colon were suspended by the dorsal mesentery based on the origin of the superior mesenteric vessels. The duodenum, jejunum, ileum, and colon lay in an unrotated position with the small intestine occupying the right half and the large intestine occupying the left half of the abdominal cavity (Figure 3). The duodenal loop was grossly dilated and foreshortened by an abnormally situated duodenojejunal junction, which was to the right of the midline. However, the jejunum and the ileum were normal in appearance, though lying in a non-rotated position with the small intestine occupying the right side of the abdomen (Figure 4), while the caecum and ascending colon lay in the midline, with the ter-

Figure 2. A photograph of case 1 showing the distribution of the intestines. The small intestine occupies the right side of the abdomen except that the terminal ileum passes upwards to the left below the lower border of the stomach, whereas the caecum lies in the left upper quadrant of the abdomen close to the midline. The ascending colon and the right two-thirds of the transverse colon also occupy the left side of the abdomen.

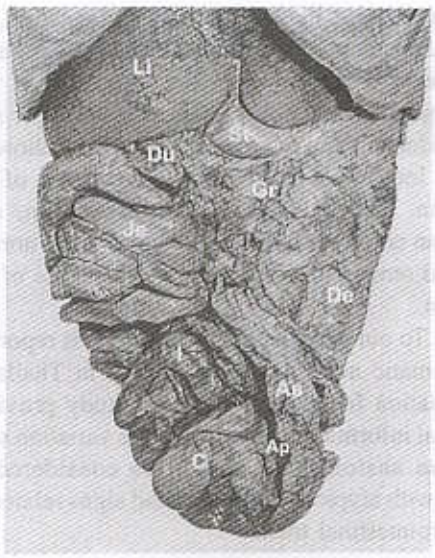

Figure 3. A photograph of case 2 showing the distribution of the intestines. The dilated duodenum, jejunum, and ileum lie on the right side of the abdomen, whereas the appendix and caecum lie in the midline, and the right two-thirds of the transverse colon lies on the left side.
(Ap = appendix, As = ascending colon, C = caecum, De = descending colon, Du = duodenum, Gr = greater omentum, I= ileum, Je = jejunum, Li = liver, St = stomach)

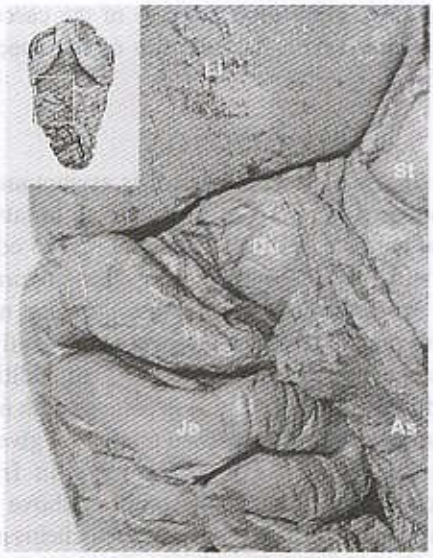

Figure 4. Higher magnification of the upper part of case 2 showing the dilatation of the duodenal loop (Du) and the jejunum (Je) lying in a non-rotated position with the small intestine occupying the right side of the abdomen.
(As = Ascending colon, Du = Duodenum, Je = Jejunum, Li = liver, St = Stomach)

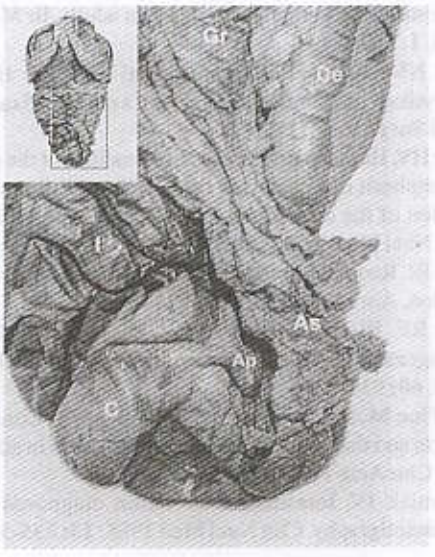

Figure 5. Higher magnification of the lower part of case 2 showing the small intestine occupying the right side of the abdomen. The caecum and ascending colon lie in the midline, with the terminal ileum entering the right side of the caecum. The appendix enters the left side of the caecum.
(Ap = appendix, As = ascending colon, C = caecum, De = descending colon, Gr = greater omentum, I = ileum)

minal ileum entering the right side of the caecum. The appendix lay on the left side of the caecum (Figure 5).

DISCUSSION

The present report describes asymptomatic non-rotation of the midgut in adult Thai cadavers. Non-rotation of midgut has been reported to occur with or without[11] association with other abnormalities[7-10]. From previous reports, asymtomatic non-rotation of midgut has been discovered incidently at laparotomy for another diseases[10,13,14]. In addition, various diseases of the intestine in patients with non-rotation of the midgut have been missed on given a mistaken diagnosis. For example, pain from appendicitis may occur in the midline above the umbilicus therefore, the diagnosis of appendicitis may be delayed or mistaken in patients with non-rotation of the midgut.

In these two cases, midgut rotation during the embryonic period occurred only 90-degree counterclockwise instead of a total of 270-degrees. The cause of this anomaly is not exactly known, although delay in return of the gut from its herniated position, and discrepancy in the differential growth of the coelomic cavity and the lengthening gut have been suggested as likely causes. In non-rotation, the first jejunal loop fails to pass behind the superior mesenteric vessels with the result that the duodenojejunal junction remains on the right side of the abdomen. The rest of small intestine, following the first loop, also returns to the right side of the abdomen. The caecum, ascending colon, and transverse colon are unable to assume their normal sites, and remain in the midline and left side of the abdomen.

To our knowledge, this is the first report of asymptomatic non-rotation of midgut in Thailand. The variation found in the present study provides additional information concerning the variation seen in human anatomy and should be considered in patients with atypical symptoms and signs related to the gastrointestinal tract.

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