Gastric cancer is among the most common cancers worldwide, and it is heavily dependent on both personal diet and bacterial infections. In 2020, the World Health Organization recorded over one million cases, but the rate of incidence and mortality is decreasing over time. Over the years, different treatment methods for gastric cancer have been developed, while some are still in clinical trials. The recent advances in surgical procedures and medical technology and instruments have made the process of laparoscopic gastrectomy a widely performed method of treatment, as it can be applied to all stages of the gastric cancer and is minimally invasive.

To be able to carry out safe surgical procedures, there needs to be an excellent understanding of the arteries in the abdominal cavity, how they are branching, where they are located, and how they are connected to the lymph nodes (LNs) and lymph flow. Mistakes in these procedures can lead to post-operative complications, such as pancreatitis (inflammation of the pancreas), peripancreatic abscess (collection of pus resulting from tissue necrosis, liquefaction, or infection), or pancreatic fistula (abnormal communication between the pancreas and the other organs due to leaking of pancreatic secretions from the damaged pancreatic duct).

WHAT IS AN ADACHI TYPE VI ANOMALY?
In 1928, Buntaro Adachi classified six types and 28 groups of different anatomical variations of the branching of the celiac artery, which is the major abdominal artery supplying the foregut. Adachi type VI is a very rare anomaly of the branching, occurring in only 2% of people. In this type, the common hepatic artery (CHA) is absent in the superior edge of the pancreas. The CHA branches out of the superior mesenteric artery (SMA) instead.

The different positioning of the arteries changes the normal lymph flow route. This change is crucial to understand and report, especially for preoperative diagnostics and preparations of gastric cancer patients for surgery, as it plays a major role in detecting metastases – secondary tumours away from the original location – and avoiding incidents at the upper margin of the pancreas.

THE CASE STUDY
In 2020, Dr Kenjiro Hirai and his team from the University of Kyoto described in detail the laparoscopic gastrectomy they conducted on a 77-year-old male patient with gastric cancer Adachi type VI. Their study provided the first instance of a metastasis in the superior mesenteric artery LN for Adachi type VI. This was discovered three years after the surgery had been done, during a computerised tomography (CT) scan. CT scans are usually used to obtain detailed internal images without physically entering the body.
In order to understand the potential direction of metastasis of the gastric cancer, we need to know the possible routes it can take to the lungs.

The scan showed a regional swelling of the superior mesenteric artery LN and a swelling in the midadventitial LN, in the area separating the lungs. It also showed a cancerous pleuritis, which is an inflammation of the chest cavity membrane. These signs led to a diagnosis of a recurrent gastric cancer.

With their case study, Hirai and his team provide a suggestion for considering specific regions for dissection when approaching a surgical procedure for such treatment of Adachi type VI gastric cancer patients, in case metastases are detected in the preoperative imaging.

THE PROCESS

Normally, in the dissection during surgery the pancreatic capsule needs to be incised at the upper margin of the pancreas with a good deal of caution to avoid the spread of cancer via the LNs. This process exposes the CHA and the splenic arteries to allow for dissection.

However, in Adachi type VI patients, the CHA is absent in the upper margin of the pancreas. Therefore, in order to facilitate the laparoscopic gastrectomy, the dorsal (or posterior) margin of the dissection is established by the portal vein instead. The scientists refer to this area as No 8a.

Furthermore, Hirai and his team established that the right margin of the LN No 8a can be defined by the courses of the gastroduodenal and the proper hepatic arteries. These are the arteries that supply the bottom part of the stomach, the top of the intestines, and the pancreas. After establishing these boundaries, the frontal (or anterior), side of the PV is exposed, which allows access to the LN No 8a with a good angle to perform the dissection, while preserving the tissue layer.

In order to understand the potential direction of metastasis of gastric cancer, we need to know the possible routes it can take to the lungs. Generally, three routes have been described in previous studies that the cancerous cells can take to migrate. Hirai and his colleagues suggest that the most probable for their case is the regional lymphatic route from the superior mesenteric artery LN. This route goes to the lungs via the vena cava, which is the main vein carrying blood from the body back to the heart, and the lymphatic vessels.

The area referred to as the LN No 6 infrapyloric group is where the lymphatic fluid in the Adachi type VI changes flow from its normal route (see Figure 1). LN No 6 and LN No 4d, otherwise known as the greater curvature right group, are the groups of LNs that drain the lymphatic flow from the vessels that run along the curvature of the stomach (called gastroepiploic vessels). These are important to locate as they can play an important role in the route of the metastasis.

The lymph flow route at No 6 is divided into three regions: the 6a, the 6v, and the 6i. LN No 6a is the region which involves the right gastroepiploic artery root and the first vessel of the greater curvature, or the dorsal mesogastrium. The LN No 6i is the periphery of the right gastroepiploic vein (RGEV), or mesoduodenum. The LN No 6v is the infrapyloric mesentery including both the infrapyloric artery and vein (IPA/V).

The team of surgeons noticed evidence of cancer spread in both the LN No 6a and LN No 4d regions, but not along the celiac artery. Therefore, they speculate that the gastric cancer metastasizes to the SMA LN Adachi type VI patients via the GDA, and not via the celiac artery as it does in the normal branching.

SAFE, EFFECTIVE SURGERY

Overall, this study is highly valuable as it is the first to report a metastasis of gastric cancer to the SMA LN after surgery in the Adachi type VI anomaly. The research team propose that when scan images before surgery indicate that there is metastasis from the stomach to the infrapyloric and greater curvature right group LNs, then the surgery should be considered with a dissection along the CHA that originates from the SMA and the hepatomesenteric trunk. This knowledge could facilitate safer and more effective surgeries.

Reference:


Personal Response

Has a similar study been done on other types of Adachi variations of branching? What would their importance be?

In recent years, laparoscopic surgery for gastric cancer with vascular anomaly of the celiac artery branch known as Adachi classification has become common. However, little research has been done on this mechanism of lymph node metastasis of gastric cancer with vascular anomaly. We believe that our research will help to facilitate safe surgery for gastric cancer and will elucidate lymph node metastasis pathways.