8 Gastrectomy with D3 Lymph Node Dissection

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Indication

Prophylactic Nodal Dissection

Japan Clinical Oncology Group (JCOG) carried out a phase III study on prophylactic nodal dissection of para-aortic lymph nodes (PAN) for potentially curable T3/T4 advanced gastric cancer [1]. This study, JCOG9501, is a multi-institutional prospective randomized control study carried out among 24 Japanese hospitals to evaluate superiority of D2 + PAN dissection (D) over D2 alone. Eligibility criteria are shown in Table 8.1. The primary end point was overall survival (OS), and the secondary were recurrent-free survival (RFS) and surgery-related complications and hospital death. The sample size was projected as 520 to detect 8% increase of 5-year survival rate for PAND with a one-sided alpha level of 0.05 and power of 80%. Between July 1995 and April 2001, 523 patients were randomly assigned to D2 alone (263) or D2 plus PAND (260) (Fig. 8.1). All except one underwent allocated nodal dissection and followed without any adjuvant treatment. In terms of patients' characteristics and prognostic factors, there was no difference between the two groups. Hospital death in both groups was as low as 0.8%. Incidence of major surgical complication such as anastomotic leak, intra-abdominal abscess, or pancreatic juice leak was the same between two groups, but that of total morbidity including minor complication was significantly higher after D2 + PAND than D2 [2]. Both OS and RFS curves were nearly completely overlapped, and HR was 1.03 (95% IC; 0.78–1.37; $p = 0.83$) (Fig. 8.2) and 1.08 (95% CI; 0.83–1.42; $p = 0.72$) (Fig. 8.3), respectively. Sites of initial recurrent did not show any difference between the two groups. In subgroup analysis, pathological tumor stage and lymph node stage (negative/positive) showed statistically significant interaction, but both of them cannot be known when performing surgery, and reasonable explanation could not be given. Although the interaction was not significant, hazard ratio for tumors of the upper third of the stomach was

Table 8.1 Eligibility criteria

Inclusion criteria	Exclusion criteria
Pre-op	*Pre-op*
Adenocarcinoma 75 yrs or younger PaO2 > 70 mmHg, FEV1.0 > 50% CCr > 50 ml/min Written consent	Cancer in gastric stump Borrmann 4 (linitis) Other primary neoplasm History of MI or positive exercise ECG Liver cirrhosis or ICG15 > 10%
Intra-op	*Intra-op*
T2(SS), T3, T4 Curative resection (R0) Lavage cytology negative	Macroscopic N4 (frozen section not allowed)

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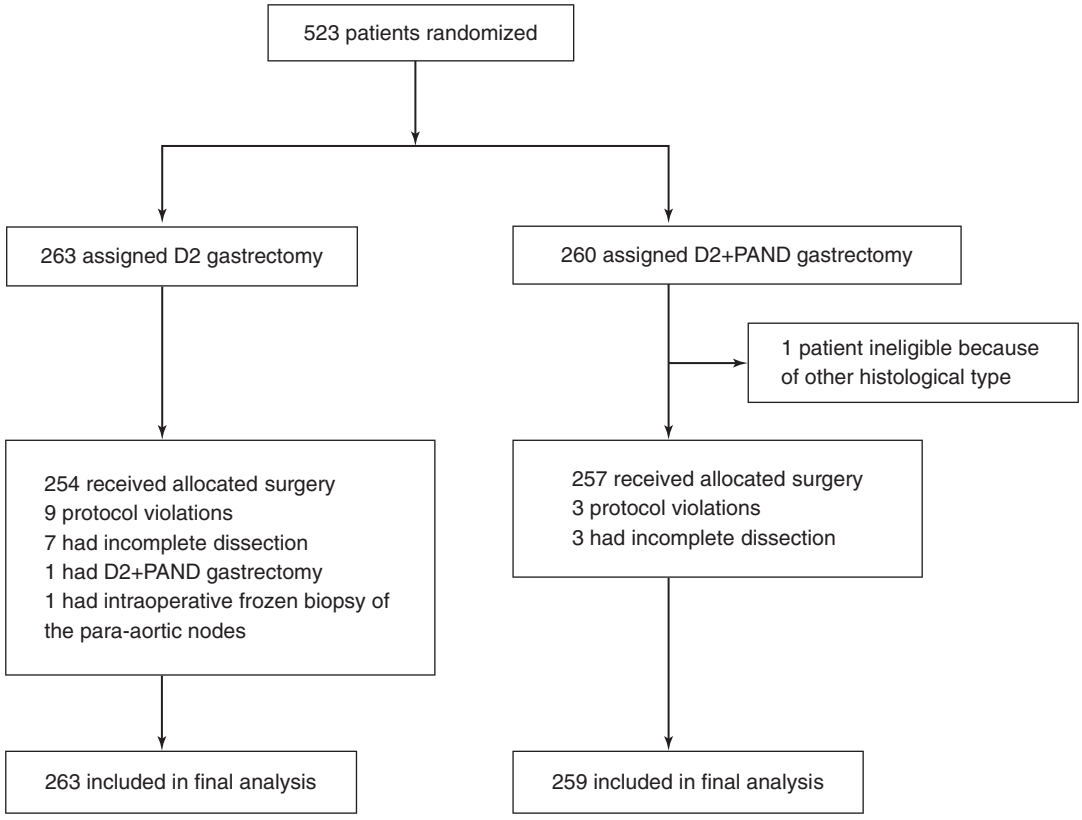
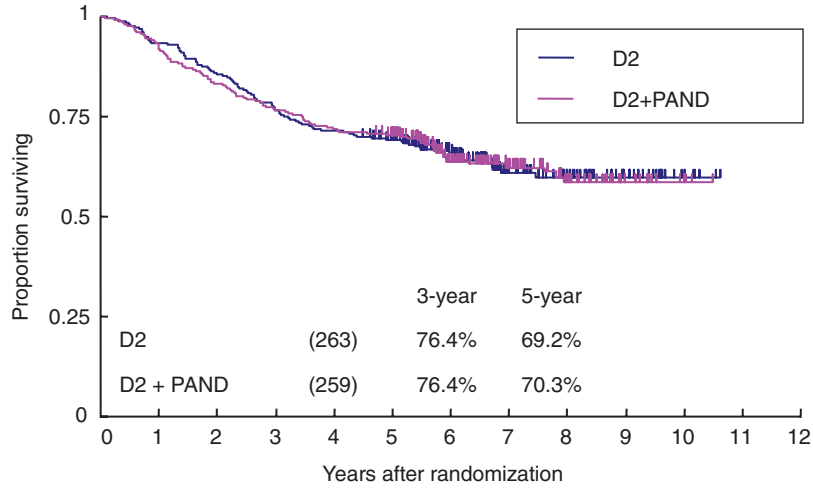


Fig. 8.1 Consort flow chart of the JCOG9501

Fig. 8.2 OS curves of the two arms



*: Survival analysis excluded ineligible patients (n=1).
Stratified log-rank test: P=0.57, HR=1.03 (0.77-1.37)

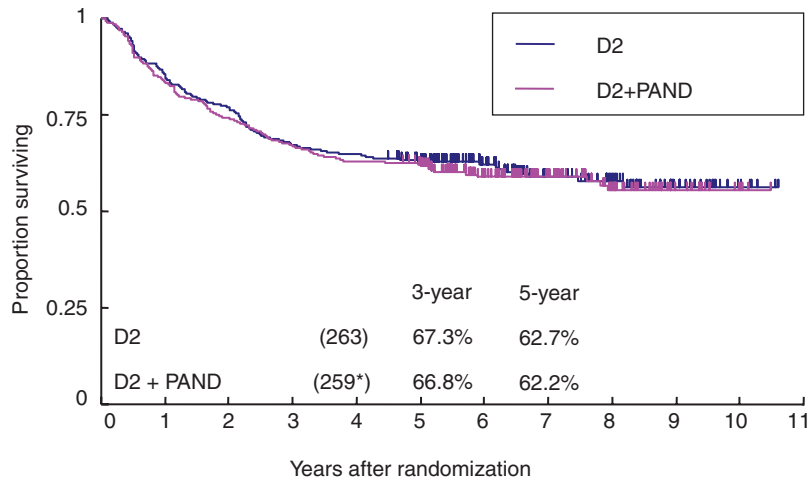


Fig. 8.3 RFS curves of the two arms

*: Survival analysis excluded ineligible patients (n=1).

Stratified log-rank test: 1 sided P=0.66, HR=1.06 (0.81-1.39)

0.58, while that of other locations was 1.10. Five-year OS of 22 out of 260 (8.5%) patients who had PAN metastasis was 18.2%, which was almost same as our expectation. In summary, PAND should be avoided in patients with potentially curable T3/4 tumors without any clinical evidence of PAN metastasis.

In JCOG9501 study, we excluded patients with tumors invading the cardia and esophagus, as we carried out at the same time another study JCOG9502 for these patients to test the superiority of left thoracoabdominal approach over transdiaphragmatic approach [3]. In the subgroup analysis of JCOG9501, tumors of the upper third of the stomach may have more benefit from PAND than tumors of other middle or lower third of the stomach [1]. In JCOG9502, the incidence of PAN metastasis was more than double of JCOG9501, 15.2%, and 5-year OS of these patients was 18.2%, showing much higher efficacy of PAND for these tumors [3]. Prophylactic PAND is not recommended, but partial PAND, area limited to the lateral to the aorta and above the left renal vein, might be considered for patients with Siewert type II or III tumors.

Therapeutic Dissection

It has long been known that some patients with PAN metastasis can be cured by dissection of all nodes including PA area, although the proportion of cured patients was as low as 10%. The Stomach Cancer Study Group (SCSG) of the JCOG has made several clinical studies on gastric cancer patients with extended lymph nodal disease, having either bulky metastatic nodes surrounding the celiac artery or its branches (conglomerate nodes of 3 cm or larger or two or more nodes of 1.5 cm or larger) or PAN larger than 10 mm. In the first study on this issue, neoadjuvant chemotherapy (NAC) by irinotecan plus cisplatin followed by D2 + PAND demonstrated 3-year OS of 27% (95% CI, 15–39%), while there were three treatment-related deaths [4]. In the second study, chemotherapy used for NAC was S-1 plus cisplatin. The 3- and 5-year OS of 51 eligible patients were 59% and 53%, respectively [5] (Fig. 8.4). The 5-year OS of those with clinical PAN metastasis without bulky N2 was 57 and that of those with both bulky N2 and PAN metastasis was 17%. In these two studies, histologically detected nodal metastasis of PAN among those without

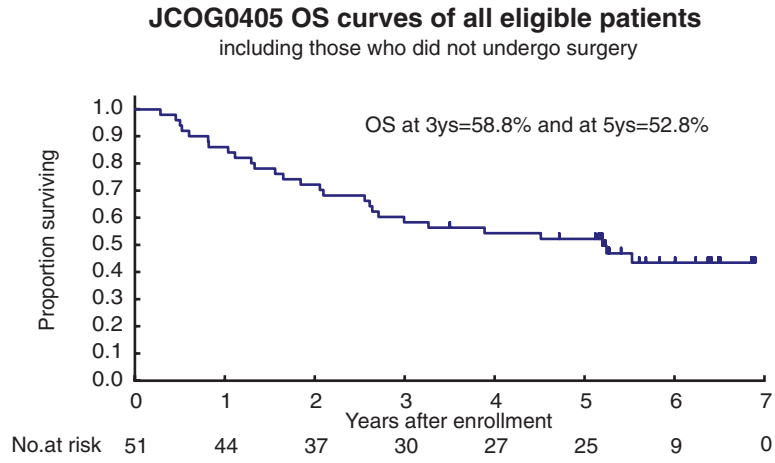


Fig. 8.4 OS curve of the patients enrolled in the JCOG0405

clinical metastasis in PAN was seen in 30% and 20%, respectively. Thus even for bulky N2 without PAN metastasis, PAND should be carried out after prompt NAC.

Technique

1. *Extensive Kocher's maneuver (including mobilization of the hepatic flexure).*

   First step of PAND is extensive mobilization of the duodenum from the retroperitoneum. In this procedure, the hepatic flexure of the colon should be mobilized extensively to get a wide view of the PA area (Fig. 8.5). We should get in the layer immediately beneath the duodenum and the pancreas along the retro-pancreatic fascia covering the entire PAN area (Fig. 8.6). Dissection along this layer should be continued up to near the left kidney (Fig. 8.7). The inferior mesenteric vein can be seen from behind.
2. *Division of the membrane on the inferior vena cava (IVC).*

   The membrane covering the PA area, which also covers the vena cava, is divided longitudinally on the vena cava from about the position of the inferior mesenteric artery to the level of the left renal vein (Fig. 8.8). Following the exposed surface of the vena cava, the origin of the left renal vein can be easily found. Going caudally, the origin of the right gonadal vein is found, and the vein

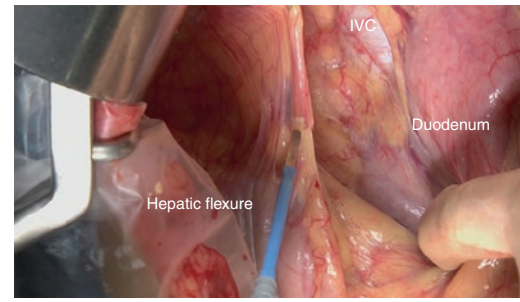


Fig. 8.5 Mobilization of the hepatic flexure

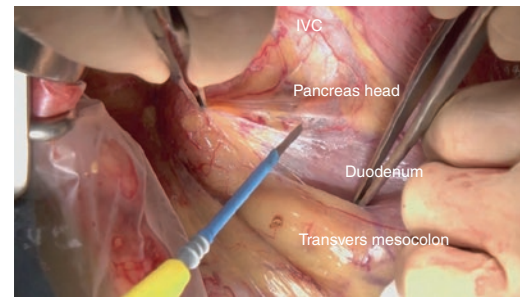


Fig. 8.6 Wide mobilization just beneath the retropancreatic fascia

should be cut at its origin (Fig. 8.9). The ventral surface of the left renal vein should be exposed till the origin of the left adrenal vein. As the whole PA area cannot be dissected en bloc in one piece, it should be divided at the level of the left renal vein. The tissue ventral to the left renal vein is ligated and divided (Fig. 8.10). As this tissue contains many large lymphatic vessels running

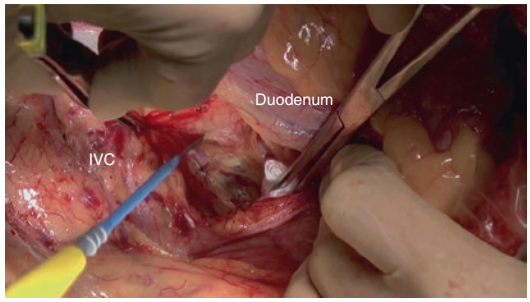


Fig. 8.7 Dissection along the retropancreatic fascia up to near the left kidney hilum

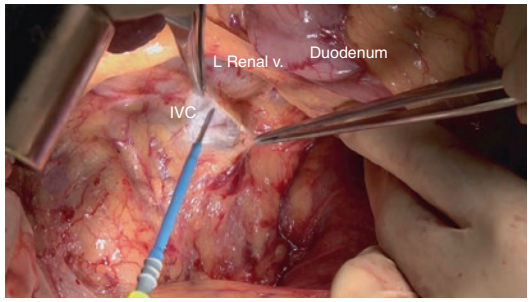


Fig. 8.8 Membrane covering the PA tissue is divided on the IVC to expose it

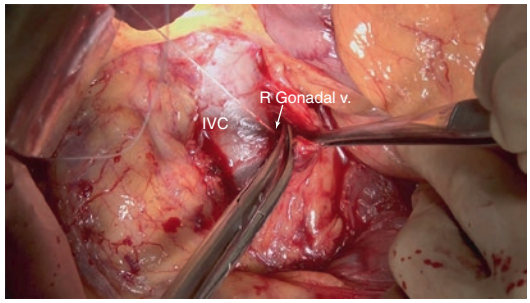


Fig. 8.9 Ligation and division of the right gonadal vein at its origin

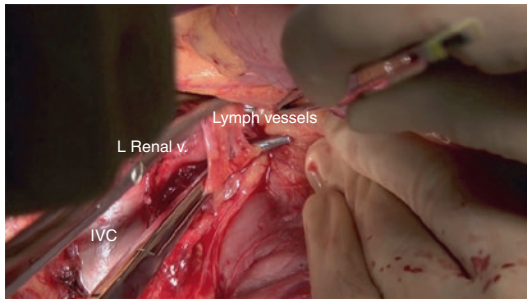


Fig. 8.10 PA tissue including large lymphatics should be ligated and divided upon the left renal vein

longitudinally, ligation is essential to avoid lymph ascites (chylo-ascites).

3. *Taping of the left renal vein (LRV) and exposing the surface of the aorta.*

   The left renal vein is taped around (Fig. 8.11) and pulled ventrally to expose the ventral surface of the aorta. The aorta is covered with thick adipose connective tissue, and it should be divided behind the left renal vein, as it is the thinnest at that level.

4. *Getting access to the bottom of the paraaortic tissue right to the aorta.*

   Dissecting the left lateral side of the IVC toward the back, we can expose the distal end of the right crus and the surface of the psoas muscle. Some autonomic nerve structures can be cut to access these structures. We can recognize the vein connecting with the azygos vein a few cm below the left renal vein, which can be divided at its root from the IVC (Fig. 8.12). The right renal artery can also be recognized.

5. *Dissection of the entire adipose connective tissue between the IVC and the aorta.*

   After reaching the bottom of the PA tissue, we start to dissect the tissue below the

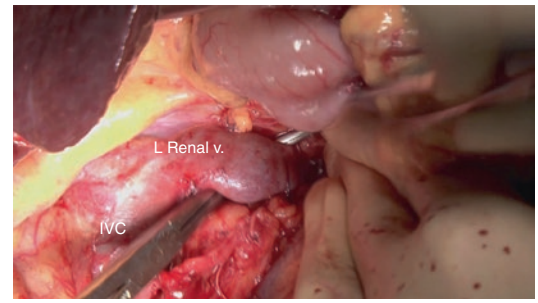


Fig. 8.11 The left renal vein is taped around

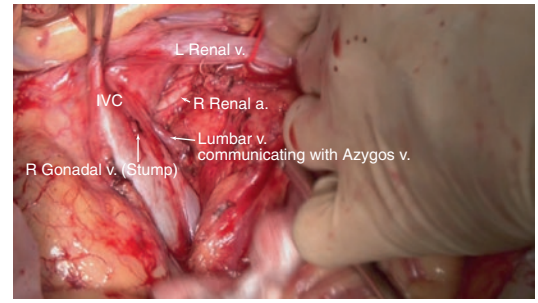


Fig. 8.12 Lumbar vein connecting with Azygous vein should be taken care

right renal artery and go along the surface of the psoas muscle caudally and from right to left toward the aorta (Fig. 8.12). The preaortic tissue is divided at the level of the left renal vein, and the origin of the left gonadal artery is exposed just a few cm below the left renal vein, and it should be divided at the origin (Fig. 8.13). In this process, the right lumbar arteries can be recognized, and the left lumbar veins cross over the psoas muscle and anterior vertebral ligament behind the aorta.

6. *Defining the caudal border of the dissection.*

   As we dissect the whole tissue between the IVC and the aorta caudally and right to left together with preaortic tissue, we can recognize the origin of the inferior mesenteric artery (IMA) after a while. It is the landmark of the inferior border of the dissection. Whole dissected tissue between the IVC and the aorta and that of pre-aorta should be ligated just below the level of the IMA (Fig. 8.14).

7. *Dissection along the left lateral side of the aorta to the posterior border.*

   Following the surface of the aorta toward left, the left gonadal artery is exposed, and it should be ligated and divided from the aorta (Fig. 8.15). Dissection is now continued along the left lateral wall of the aorta until the left lumbar veins and the anterior vertebral ligament are seen (Fig. 8.16). During this procedure, this layer is followed laterally on the fascia of the psoas muscle. Care should be taken not to injure the sympathetic nerve chain which is located on the psoas muscle.

8. *Separation of the PA tissue from the left Gerota's fascia.*

   The adipose tissue containing PAN is separated from that in the Gerota's fascia, which contains the ureter. Division from the left Gerota's fascia is performed along the left gonadal vein, which has only a couple of small branches draining from the PA area (Fig. 8.17). Separation from the left Gerota's fascia makes the lateral border of the PA tis-

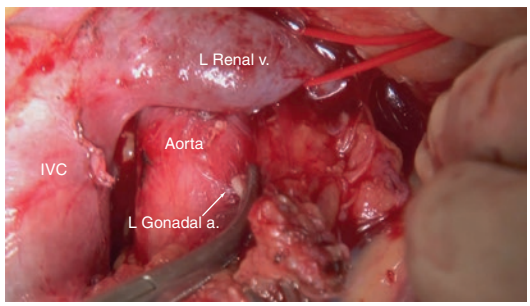


Fig. 8.13 Left gonadal artery should be divided at its origin

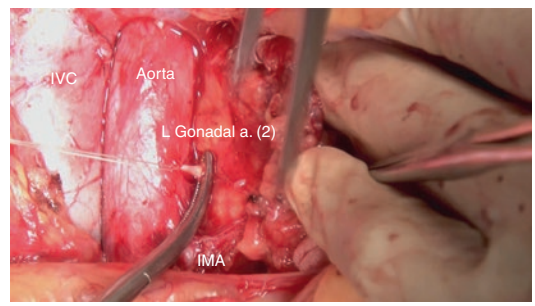


Fig. 8.15 Sometimes there are two left gonadal arteries

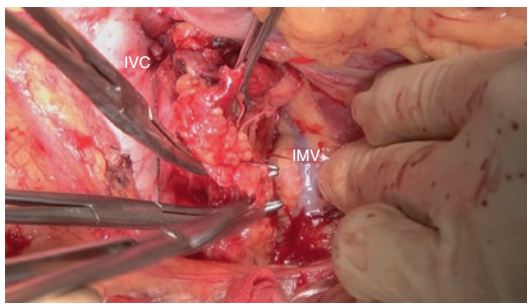


Fig. 8.14 Inferior border the the No.16 B1-int and -pre PA tissue. It should be divied just below the origin of the IMA level

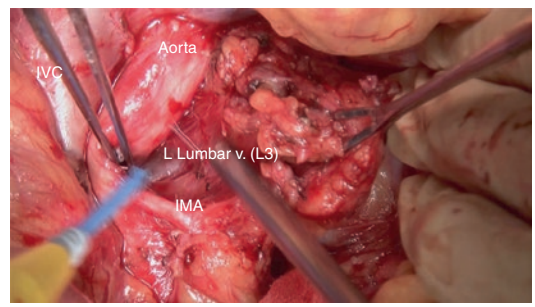


Fig. 8.16 Dissection along the left wall of the aorta is continued until the left lumbar vein and anterior vertebral ligamant are exposed

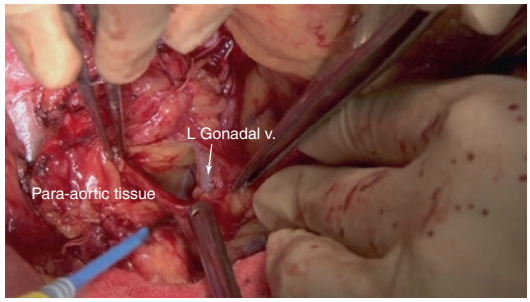


Fig. 8.17 Division along medial side of the left gonadal vein from the tissue encapsulated in the left Gerota's fascia

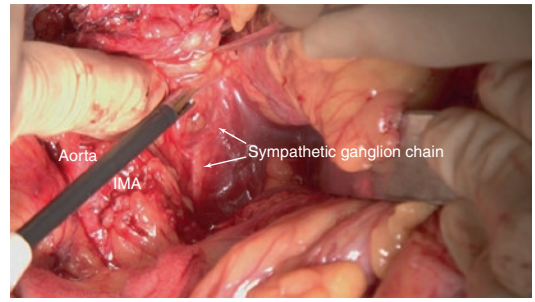


Fig. 8.19 Dissection should not go behind the left sympathetic ganglion chain, which should be preserved to avoid orthostatic hypotension after surgery

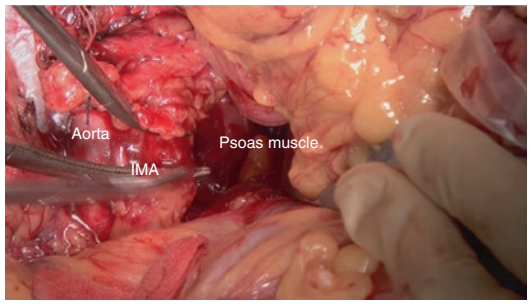


Fig. 8.18 PA tissue lateral to the aorta is divided just below the origin of the IMA

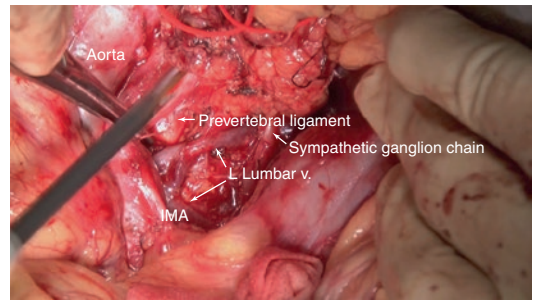


Fig. 8.20 View behind the aorta

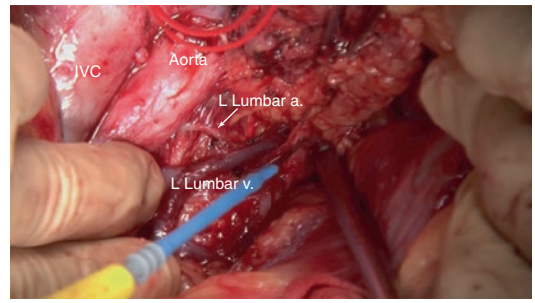


Fig. 8.21 View behind the aorta, slightly cranial to the Fig. 8.20

sue clear. Once the posterior Gerota's fascia is exposed, we can easily get into the space behind the posterior Gerota's fascia of the left kidney. To prepare the mobilization of the left kidney, quick and blunt dissection can separate the Gerota's fascia from the fascia of the psoas and quadratus lumborum muscles.

9. *Division of the PA tissue lateral to the aorta near the IMA.*

   Just like the PA tissue between the IVC and the aorta, this part of PA tissue is ligated and divided at just below the level of the IMA (Fig. 8.18). Now the PA tissue is dissected from the posterior, inferior, and left lateral structures en bloc.

   The left sympathetic ganglion chain can be recognized and preserved (Fig. 8.19). Median to the sympathetic ganglion chain and posterior to the aorta, left lumbar veins and artery can be seen and should be preserved (Figs. 8.20 and 8.21).

10. *Division of the PA tissue ventral to the renal left vein and exposure of the left renal artery.*

As the whole PA tissue cannot be dissected en bloc due to existence of the left renal vessels, the tissue lateral to the aorta is divided from the tissue cranial to the left renal vein. Firstly the tissue anterior to the left renal vein is divided. By this procedure, the left renal vein is clearly exposed, and the origin of the left adrenal vein can be recognized. Then the left renal artery, which exists in most cases a few centimeters cranial and behind the left renal vein, is exposed to avoid its injury (Fig. 8.22). Then the PA tissue

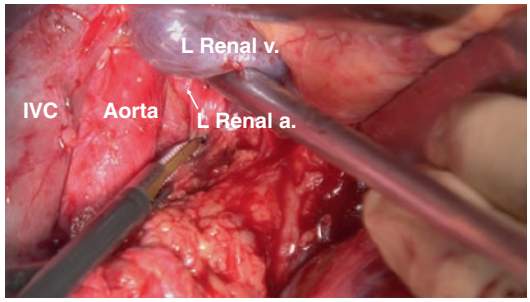


Fig. 8.22 Left renal arteries should be searched carefully along the left side of the aorta. Not commonly but occasionally there are a few of them

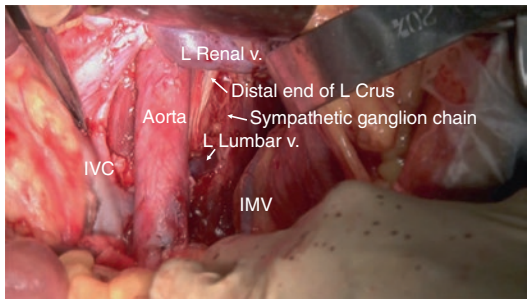


Fig. 8.23 View after dissection of No.16B1(-int, and -lat)

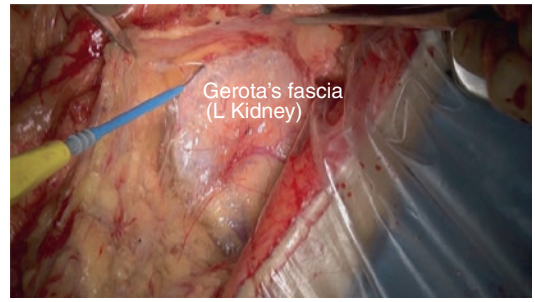


Fig. 8.24 The left colonic mesentery lying over the left Gerota's fascia is completely mobilized from it

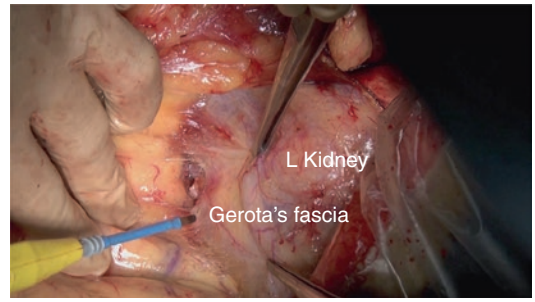


Fig. 8.25 Almost final point of the mobilization and dissection

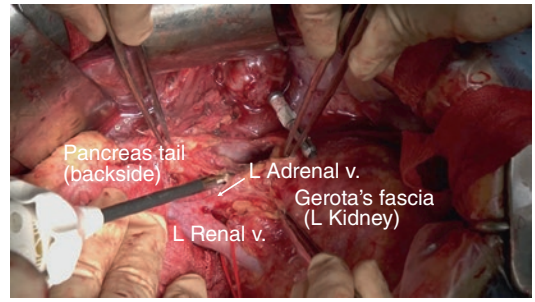


Fig. 8.26 When the left side colonic mesentery is mobilized widely together with the pancreas tail and the spleen, left renal vein and left adrenal vein are seen from anterior

below the left renal artery and dorsal to the left renal vein is divided from the cranial PA tissue. Figure 8.23 shows view after dissection of the 16B1 (para-aortic nodes between the left renal vein and the inferior mesenteric artery).

11. *Mobilization of the splenic flexure and exposure of the left Gerota's fascia.*

    After mobilizing the splenic flexure of the colon, the anterior Gerota's fascia is exposed widely until it is completely separated from the mesocolon (Figs. 8.24 and 8.25).

12. *Exposure of the left adrenal vein and the common trunk of hemiazygos and lumbar vein.*

    When the splenic flexure and the left half of the transverse colon are completely mobilized from the left retroperitoneum, the left kidney and the renal vein can be seen from anterior (Fig. 8.26). The origin of the left adrenal vein is also recognized. Near the origin of the left adrenal vein, the common trunk of lumbar vein and hemiazygos vein which goes caudally is ligated and divided from the left renal vein. The tissue containing lymph nodes along the left subphrenic vessels and median to the left adrenal gland is dissected. The dorsal border is the celiac ganglion.

13. *Mobilization of the left kidney and dissection of the tissue behind the renal vessels.*

    After putting the tapes on the left renal artery and vein, the left kidney is turned up, and tissue behind the left renal vessels is dissected carefully from these vessels (Figs. 8.27 and 8.28). The view after complete dissection of the PAN tissue is shown (Fig. 8.29).

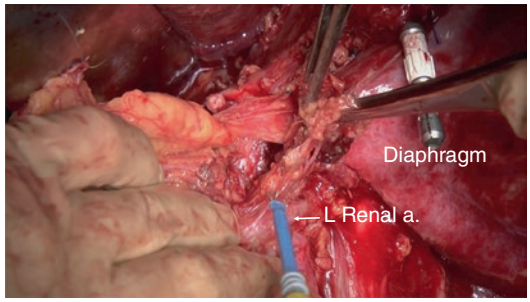


Fig. 8.27 Final step of the dissection of A2-lat: tissue surrounding the left renal vessels including that behind the vessels are completely dissected with the left kidney turned up

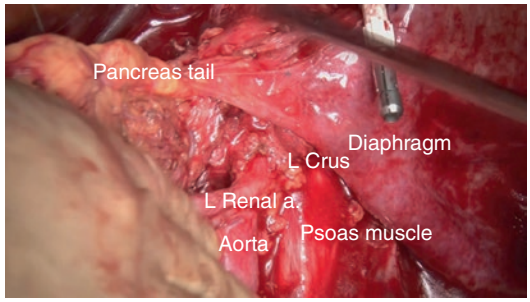


Fig. 8.28 View after complete dissection with the left kidney in operator's left hand

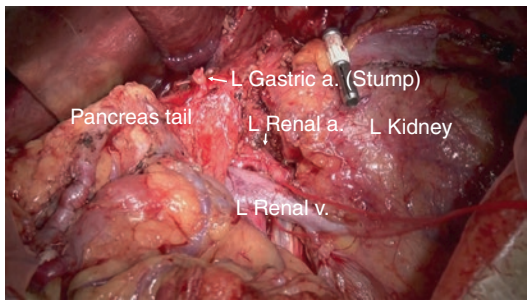


Fig. 8.29 Final view of the entire procedure

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