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CASE REPORT

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Celiac plexus neurolysis in pancreatic neoplasm with celiacomesenteric trunk: a case report

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Abstract

Background Celiac plexus neurolysis is an effective mode of long-term palliation of somatic pain in inoperable upper gastro-intestinal neoplasm. CT guidance is the most accepted method of localising the tip of the needle, through which, the neurolytic agent, commonly Absolute Alcohol, is introduced along the celiac ganglion. Three dimensional assessment of the retroperitoneal anatomy avoids injury to adjacent viscera and vascular structures. Para-aortic needle tip position between the origins of celiac and superior mesenteric arteries is an accepted position to inject neurolytic agent. We report a case of successful celiac plexus neurolysis in a patient with a celiacomesenteric trunk. Till date no such case has been reported, primarily due to the Low incidence of celiacomesenteric trunk.

Case presentation A 63-year-old man developed progressive icterus and severe abdominal pain over 3 months. The pain severity was 6/10. An Ultrasonography and contrast enhanced CT of the abdomen revealed inoperable carcinoma of head of pancreas and a celiacomesenteric trunk. The pancreatic mass extended along the right lateral border of the celiacomesenteric trunk, not extending upto the aorta. Considering the severity of pain, poor compliance to opioid pain medication, and a possibility of early tumour extension upto the aortic margin, celiac plexus neurolysis was considered. The procedure was performed under CT guidance and local anaesthesia, using a mixture of absolute alcohol, Bupivacaine and diluted iodinated contrast. Bilateral paravertebral antecrural access was performed, using 22 gauge Chiba needles, after localisation on preprocedural CT-scan. On the left, hydrodissection was performed using normal saline, to displace the left renal parenchyma from the trajectory of the needle to be used for neurolysis. The patient's pain visual analogue scale score reduced to 0/10, immediately after the procedure. He had a post procedural hypotension, managed conservatively by complete bed rest for 1 day and intravenous fluid administration.

Conclusions Celiac plexus neurolysis can safely be done in aberrant upper abdominal vascular anatomy, under CT guidance and local anaesthesia. To avoid periprocedural complications, hydrodissection may be effectively used to displace normal anatomical structures from the trajectory of the access needle, through which a mixture of absolute alcohol and local anaesthetic may be delivered.

Keywords Celiac plexus neurolysis, Celiacomesenteric trunk, Hydrodissection, Carcinoma pancreas, Pain palliation

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Background

Celiac and superior mesenteric arteries are two major proximal abdominal aortic branches supplying stomach to proximal two-thirds of the transverse colon. A celiacomesenteric trunk is a common origin of the celiac and superior mesenteric arteries, and is a rare anatomical variation, with an incidence of 0.25–2.4% [1, 2]. The knowledge of this variation is essential for planning of surgical and radiological interventions. The global incidence of pancreatic cancer is 12.4 per 100,000 person per year. A good majority of them are detected in a later stage when curative surgery is not an option [3].

Chronic, severe upper abdominal pain, in advanced, inoperable pancreatic neoplasm may be managed with analgesia as per WHO (World Health Organisation) analgesic ladder [4]. However, in cases of pancreatic neoplasm, the chance of disease progression, with early infiltration of the celiac plexus is high. This renders early interventional pain palliation a suitable option in the course of the disease. We, at our institution, are keen on improving the quality of life of such patients. As such, primary celiac plexus neurolysis helps in avoiding opioid dependence and related side effects in this subset of patients, in accordance with the opinion of Jonathan M Wyse [5].

CT (Computed Tomography) guidance is the most accepted method of localising the tip of the needle, through which, the neurolytic agent, commonly Absolute Alcohol, is introduced in close proximity of the celiac ganglion [6]. The three dimensional assessment of the retroperitoneal anatomy avoids injury to adjacent viscera and vascular structures. As such, para-aortic needle tip position between the origins of celiac and superior mesenteric arteries is an accepted position to inject neurolytic agent, in close proximity of the celiac ganglion.

We report a case of successful celiac plexus neurolysis in a patient with a celiacomesenteric trunk. To the best of our knowledge, no such case has been reported, primarily due to the low incidence of celiomesenteric trunk [1, 2]

Case presentation

A 63-year-old man developed progressive icterus and severe abdominal pain over 3 months. The pain severity was 6/10, according to visual analogue scale.

An USG (Ultrasonography) followed by CECT (Contrast enhanced computed tomography scan) of the abdomen revealed a 3.9 × 4.5 cm neoplastic mass involving the head and uncinate process of pancreas. Antero-laterally, the mass abuts the pylorus of stomach, D1 and D2 segments of the duodenum, with loss of interval fat planes. Posteriorly, this extends along the right lateral margin of the celiacomesenteric trunk, not extending upto the anterior wall of the aorta. The ostium of the celiacomesenteric trunk is at the level of L1 vertebral body. There is an independent origin of the left gastric artery, 1 cm cranial to the level of the origin of the celiacomesenteric trunk (Fig. 1).

The mass encases the right hepatic, gastroduodenal and proximal superior mesenteric (immediately distal to the bifurcation of the celiacomesenteric trunk) arteries. This also encases the extrahepatic portal vein, with thrombosis of the distal superior mesenteric, splenic and proximal extrahepatic portal veins (Fig. 2).

The mass also encases the distal common hepatic duct with superior periductal infiltration into the cystic and common hepatic ducts, and moderate intrahepatic biliary dilatation (Fig. 3). Multiple, rounded, partly necrotic, regional and retrocrural metastatic lymph modes are seen.

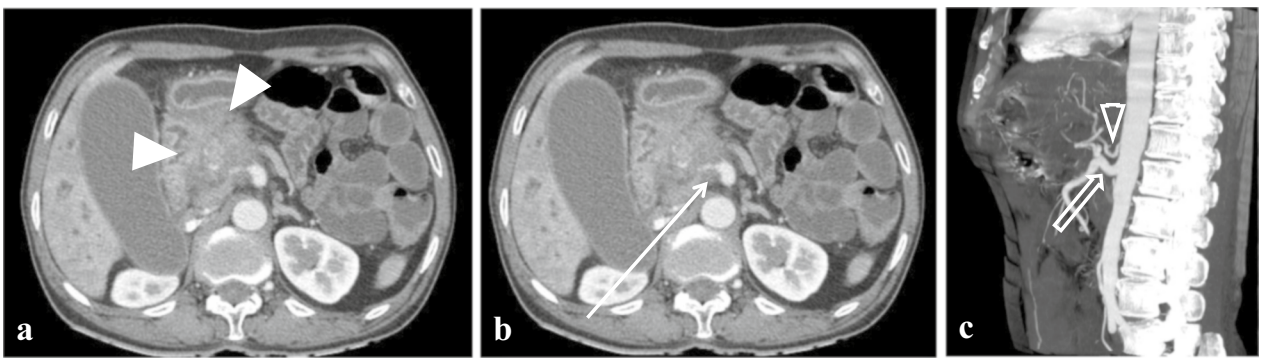

Fig. 1 Anatomical relations of the pancreatic mass: **a**. Pancreatic mass abuts the pylorus and duodenum with loss of interval fat plane (axial image, white arrowheads). **b**. Posteriorly, the mass extends along the right lateral margin of the celiacomesenteric trunk (axial image, white arrow). c. Origin of the celiacomesenteric trunk (hollow arrow) and separate origin of the left gastric artery (hollow arrowhead) (Saggital MIP image)

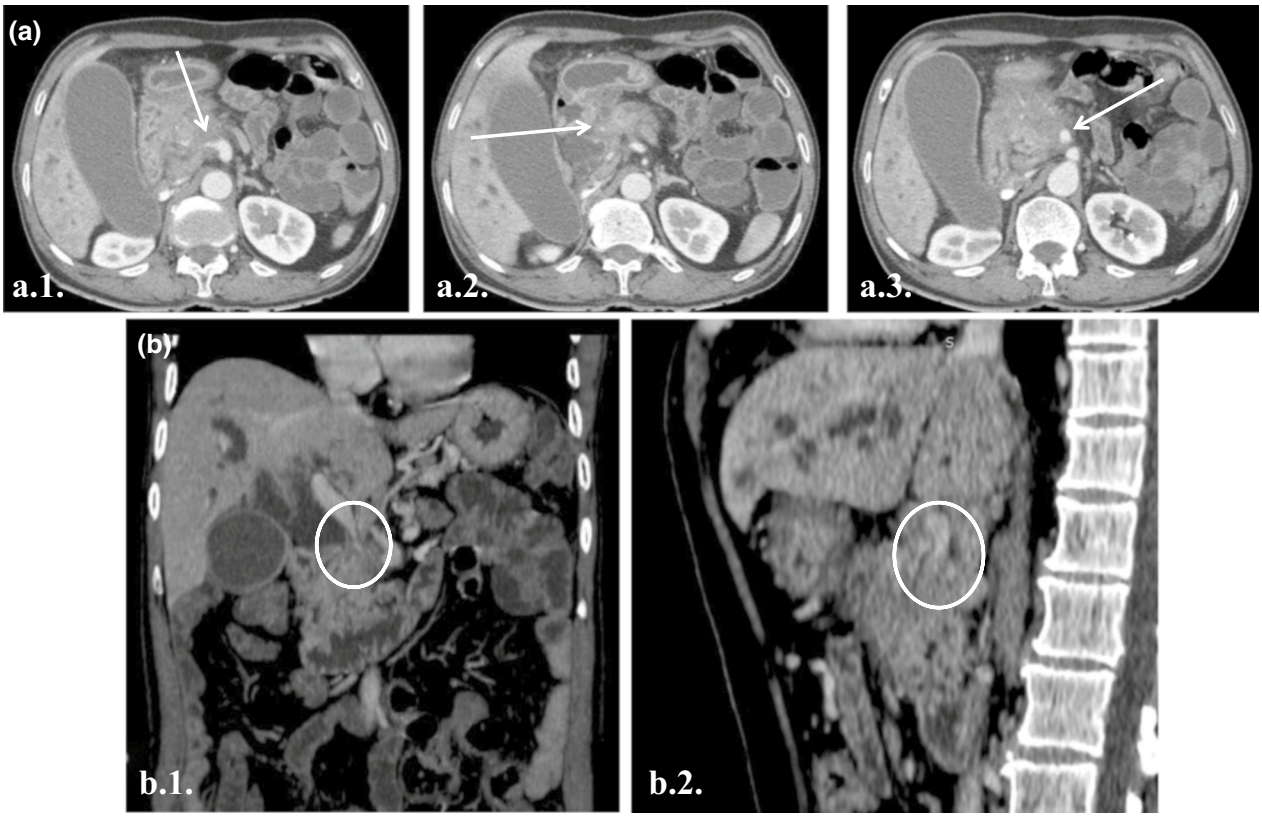

Fig. 2 Vascular encasements by the pancreatic mass: **a**. Encased right hepatic (**2.a.1**), gastroduodenal (**2.a.2**) and superior mesenteric (**2.a.3**) arteries: axial images (white arrows). **b**. Encased and thrombosed portal vein: coronal (**2.b.1**) and saggital images (**2.b.2**) (within white circle)

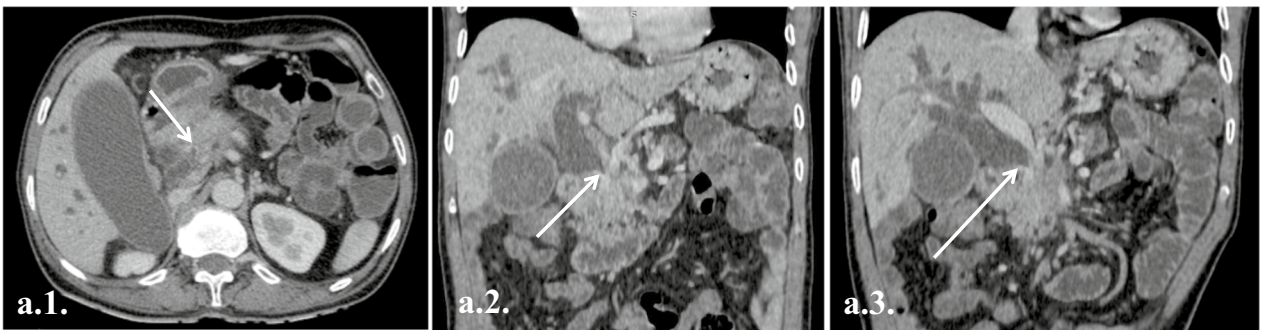

Fig. 3 Infiltration of common bile duct and intrahepatic biliary dilatation. Linear mural enhancement in the common bile duct: white arrows in axial (**3.a.1**), coronal (**3.a.2**) and oblique coronal (**3.a.3**) images

The Ca19.9 (Carbohydrate antigen 19-9) was increased at 223 U/ml (normal range < 34 U/ml).

An USG guided FNAC (Fine Needle Aspiration Cytology) from the pancreatic head mass was performed via an infragastric approach. This revealed ductal adenocarcinoma (Fig. 4).

Considering the severity of pain, poor compliance to pain medication, and a possibility of early tumour extension upto the aortic margin, a celiac plexus neurolysis was considered.

The procedure was performed under CT guidance and local anaesthesia. Bilateral paravertebral antecrural access into the para-aortic space was performed, using 22 gauge Chiba needles (Cook, Chiba Biopsy Needle, 22G/15 cm and 22G/20 cm), after localisation on pre-procedural CT scan (Fig. 5). A 16 slice CT scanner (GE

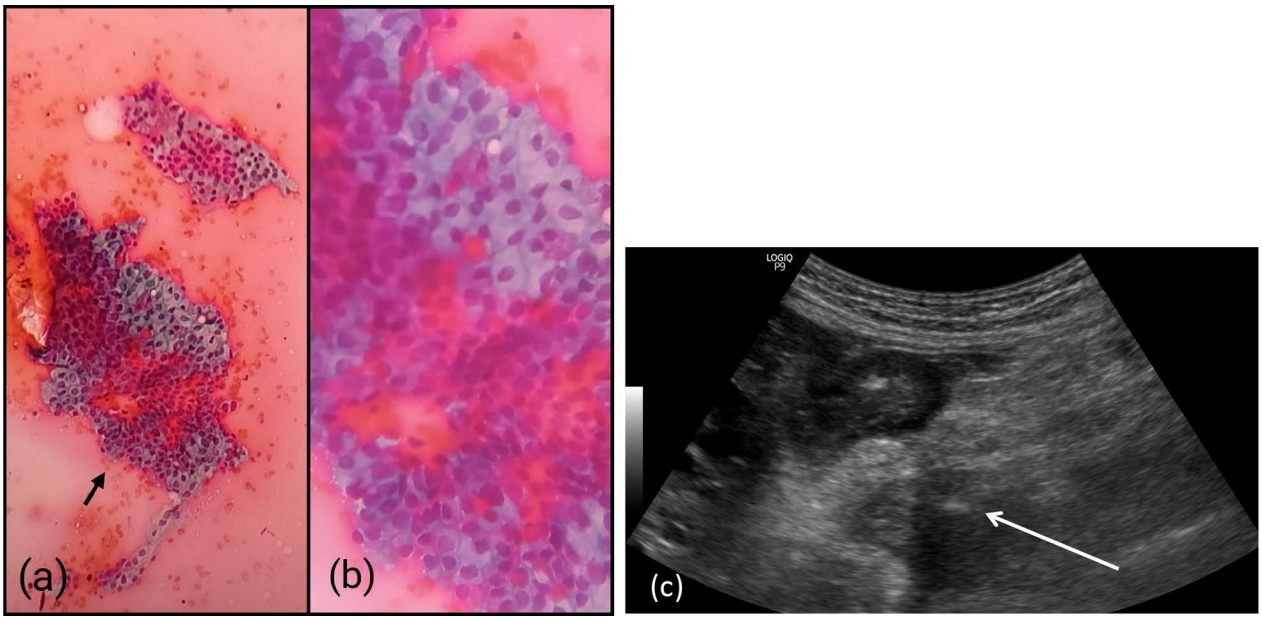

Fig. 4 Ultrasound guided Fine Needle Aspiration Cytology. **a**. Microphotograph showing uneven distribution of ductal cells within a sheet, Drunken honeycomb appearance (black arrow). (Pap stain 10×); **b**. Microphotograph showing tumour cells with irregular nuclear contours, nuclear enlargement, anisonucleosis and abundant mucinous cytoplasm. (Pap stain 40×); **c**. Ultrasound image with needle tip in the pancreatic lesion (white arrow)

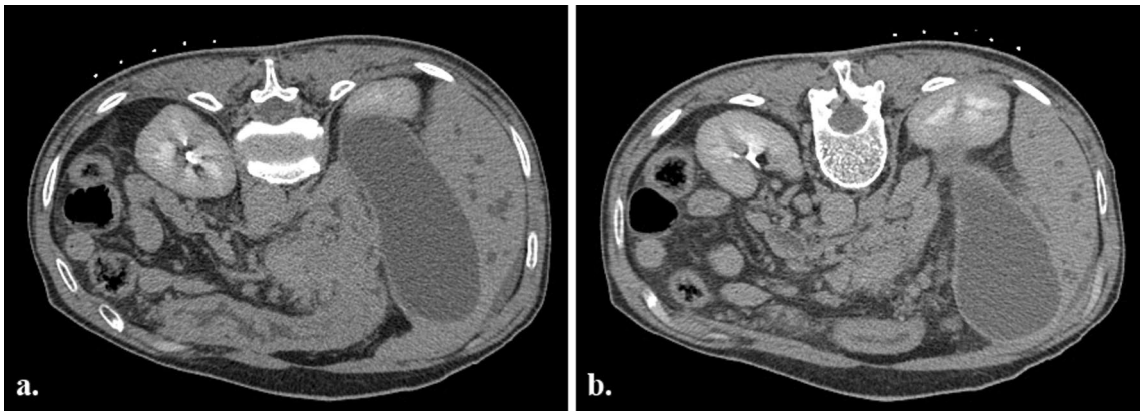

Fig. 5 Procedure planning: Access site planned by equidistantly placed covered needle markers, taped to the skin by commercially available skin adhesives. Freehand manual insertion of needle was done from these access sites. **a**. Access site for left (para-aortic access). **b**. Access site for right (aorto-caval or retrocaval access)

Optima CT 530) was used. The localisation and sequential imaging were done using a 1.2 mm slice thickness and a pitch of 0.938 and a speed of 9.37 mm/rotation. The mAs was manually fixed at 300, with a 120 kV tube current. The needles were advanced into the paravertebral region by a few centimetres in each advancement, by freehand technique, along the planned angulation on localisation scan. The tract of needle advancement was infiltrated with adequate amount of 2% lidocaine (Fig. 5).

On the left, hydrodissection [7] was performed by instilling 35 ml normal saline, via a 22 gauge lumbar puncture needle (B Braun, Spinocan, 22G × 3 ½″), with its tip in the medial perirenal space [8], between the adjacent vertebral body and the medial margin of the left kidney, to displace the left renal parenchyma from the trajectory of the needle to be used for neurolysis (Fig. 6) A mixture of 25 ml of absolute alcohol, 6 ml of 0.25% Bupivacaine and 3 ml diluted contrast (1 ml iohexol diluted in 50 ml normal saline) was instilled along the antero-lateral

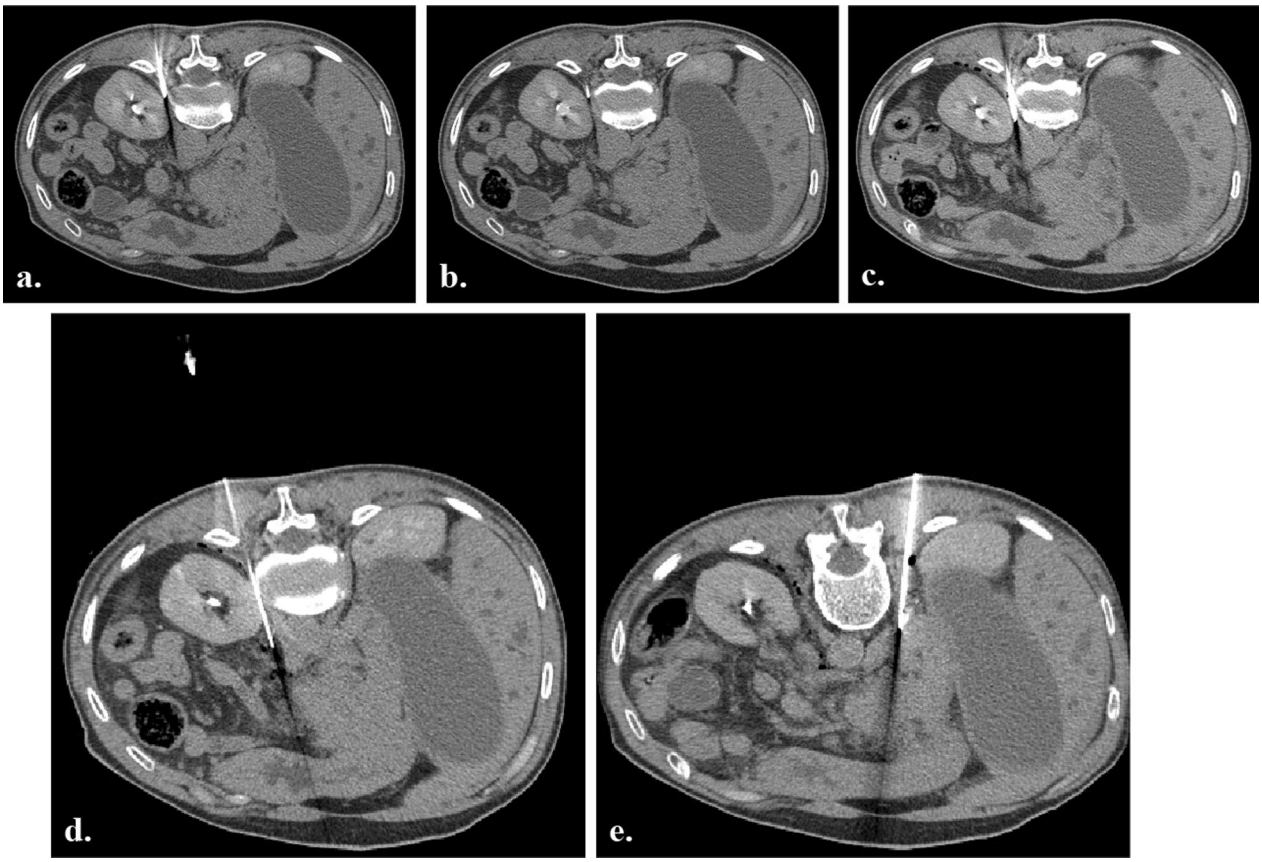

Fig. 6 Hydrodissection and needle tip positioning: **6.a**. and **6.b**. Spinal needle placed in perirenal space. **6.c**. Chiba needle advanced across the perirenal space. The perirenal space has been widened by instillation of normal saline, to avoid injury to renal parenchyma by the Chiba needle. **6.d**. Tip of Chiba needle is left anterolateral to the aorta, at the level of the origin of the celiaco-mesenteric trunk. **6.e**. Tip of the Chiba needle is between the crus of diaphragm and the IVC on the right

margin of the aorta, at the level of the origin of the celiaco-mesenteric trunk on the left, and between the IVC (Inferior vena cava) and the right crus of diaphragm on the right. The needles were aspirated prior to injection, to rule out inadvertent intravascular position of the needle tip. Prior to withdrawal of the Chiba needles, 3 ml of normal saline was administered via each needle, to flush out the absolute alcohol in the lumen of the needle, thus preventing inadvertent alcohol-ablation of the adjacent structures and a cutaneous fistula.

Post ablation, completion CT scan revealed adequate spread of the neurolytic agent in the retroperitoneal space, along the left anterolateral margin of the aorta, at the level of origin of the celiacomesenteric trunk, between the right crus of the diaphragm and IVC, and along the celiacomesenteric trunk (Fig. 7).

The patient's pain visual analogue scale score reduced to 0/10, shortly after the procedure, within the time in which he was shifted to his ward bed.

Preprocedural BP (Blood pressure) was 126/84 mm of Hg. Immediately post procedure the BP decreased to 110/76 mm of Hg. The patient was advised complete bed rest. No post procedural analgesia was administered. After about 5 h post procedure, the patient became drowsy with a BP of 90/50 mm of Hg. On examination, the pulse volume was normal. There was no tachycardia, the heart rate was stable in the range of 80 to 85 beats/min. The patient was conservatively managed with intravenous fluid bolus, and the BP increased to 100/60 mm of Hg. A Foley's catheter was inserted, and subsequently the catheter was removed, after adequate overnight urine output. He had two episodes of self-limiting diarrhoea after the procedure.

The patient did not have any pain on the next day, and was discharged with no analgesics.

Discussion

In patients with inoperable pancreatic carcinoma, early radiological interventions for pain palliation are recommended. [5] Image guided celiac plexus neurolysis is an optimal mode of such pain palliation. Percutaneous CT or USG guided (anterior approach), percutaneous CT

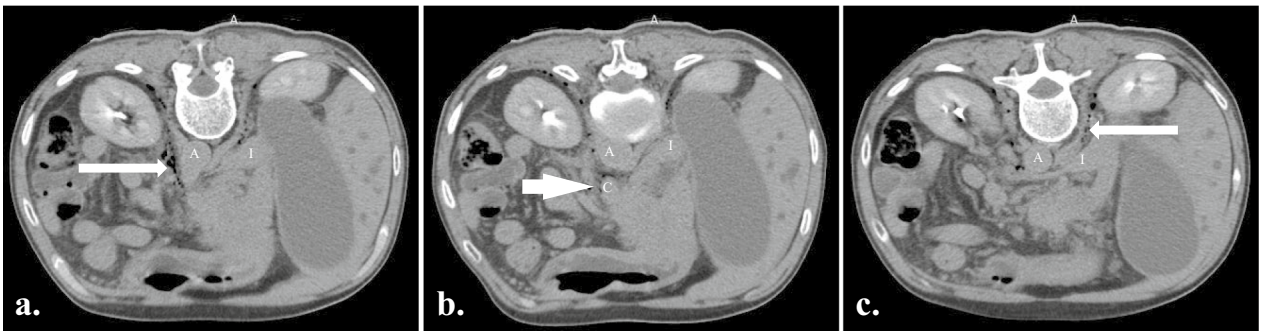

Fig. 7 Postprocedure CT scan: Adequate spread of the neurolytic agent in the paraaortic, retrocaval regions (white arrows in **7.a** and **7.c**) and surrounding the celiacomesenteric trunk (short white arrow in **7.b**.). The lucencies on CT are due to the neurolytic agent. There is no inadvertent instillation of the neurolytic agent into the retrocrural space. A: aorta; C: Celiacomesenteric trunk, I: IVC

guided (posterior approach), fluoroscopy guided (posterior approach) and EUS guided (Endoscopic ultrasound) (anterior approach) are the common modes of infusing absolute alcohol mixed with long acting anaesthetic to ablate the celiac ganglion. [6]

Both CT guided (posterior paravertebral approach) and EUS guided (anterior approach) are technically superior than the others, due to adequate visibility of the adjacent structures, and non-violation of significant organs (gut, pancreas or kidneys) in the trajectory of the ablation needle. However, CT guided celiac plexus neurolysis is a relatively simpler technique with an easy learning curve and is a less invasive process, as compared to EUS guided neurolysis, percutaneous USG guided neurolysis or fluoroscopy guided neurolysis. Moreover, there is no need for sedation and patient comfort and compliance is better. The procedure can be safely done under local anaesthesia. As the gut wall is not breached, there is no possibility of migration of gut bacteria causing a retroperitoneal abscess; an inherent potential complication of EUS guided neurolysis. After instilling of alcohol, there is a echo-cloud which causes loss of visualisation of the needle tip, and inadvertent intra-procedural displacement of the same cannot be ruled out. When the alcohol-mixture extends to the contralateral side, bilateral ablations are not possible, in EUS guided ablation, due to obscuring of the sonography window. [9] According to the review article by Andrada Seicean, most patients require same analgesic dose even after the procedure. In our patient, we obtained complete pain relief. The patient had no requirement of any analgesia, immediately after the procedure. This is probably primarily due to early intervention, and appropriate case selection, based on CT imaging. Neurolysis performed later in the disease process has limited role in pain palliation. Moreover, intraganglion injection is often inadequate to address to the various neuronal network in the visceral afferent nerve fibres which carry nociceptive stimuli originating from the pancreas and upper abdominal organs. [6, 9] As such a free diffusion of alcohol in the median, vascular retroperitoneal compartment, results in more complete neurolysis of the neuronal network. [6, 8]

There is difference of opinion about the concentration and volume of alcohol, to be used in neurolysis. [6, 10, 11]. We used 25 ml absolute alcohol diluted with 6 ml of 0.25% bupivacaine and 3 ml of diluted contrast, with a resultant alcohol concentration of 73%. Though 50% alcohol concentration is sufficient for irreversible neuronal destruction, and is recommended by Subhash Jain [10], most other authors recommended using ~ 70% alcohol concentration. [6, 11] We used a total volume of 50 ml (25 ml on either side) of alcohol, marginally more than used by Archana Dolly et. al. [11] and Subhash Jain [10] but is similar to the doses used by Hiroaki Ina et. al. [12]

CT guidance is essential for assessing anatomic variations of abdominal aorta and celiac trunk. [6] As such, this helps in unwanted bleeding complications. Our patient had an INR (International Normalized Ratio) of 1.39, and a trans-aortic approach was considered risky by the authors. In such cases, CT guidance can safely avoid any organ of vascular transgression, keeping a high intra-procedural safety profile. Moreover, an inadvertent injury to the celiacomesenteric trunk would have been clinically disastrous.

Thus the present case report underlines the utility of CT imaging as the primary tool for guidance in celiac plexus neurolysis, particularly in anatomical variation of the celiac artery as in celiacomesenteric trunk.

Conclusions

Celiac plexus neurolysis can safely be done in aberrant upper abdominal vascular anatomy, under CT guidance and local anaesthesia. To avoid periprocedural complications, hydrodissection may be effectively used to displace

normal anatomical structures from the trajectory of the access needle, through which a mixture of absolute alcohol and local anaesthetic will be delivered. Post procedural hypotension and diarrhoea are usually self-limiting and may be treated conservatively. In inoperable pancreatic carcinoma, the authors advice early radiological intervention for pain palliation, to reduce the need and dependence on opioid and non-opioid analgesics.

Abbreviations

WHO	World Health Organisation
CT	Computed tomography
USG	Ultrasonography
CECT	Contrast enhanced computed tomography scan
Ca19.9	Carbohydrate antigen 19-9—tumour marker in pancreatic neoplasms
FNAC	Fine needle aspiration cytology
IVC	Inferior vena cava
BP	Blood pressure
EUS	Endoscopic ultrasound
INR	International normalised ratio

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Not applicable.

Author contributions
The intervention was planned and executed by SP and SM. Patient selection and follow-up were done by SP, SSM and TDB. The pathological confirmation, pathology images and legend were contributed by PK. The manuscript was written by SP. All the authors have made necessary comments and contributions to the manuscript. All authors have read and approved the manuscript.

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Availability of data and materials
The data and images in the current study are available from the corresponding author, on reasonable request.

Declarations

Ethics approval and consent to participate
The procedure described was in accordance with the institutional ethical guidelines and conform to the WMA Declaration of Helsinki—Ethical principles for medical research involving human subjects.

Consent for publication
Written informed consent was obtained from the patient and patient relatives for publication of the article.

Competing interests
The authors declare that they have no competing interests.

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