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Scanographic Exploration of Pancreatic Cancers: About 30 Cases

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Abstract: ***Introduction*: 4th cause of cancer mortality and the 2nd cause of digestive cancer mortality after colorectal cancer, pancreatic cancer is a poor prognosis. The purpose of this work was to assess the role of the CT-scan in the diagnosis and resectable assessment of pancreatic tumors. *Materials and methods*: this was a retrospective, descriptive, bi-centric, one-year study involving 30 patients with a gender ratio of 2.33 in favour of men. The average age was 62.6 years with extremes of 42 and 82 years. The examinations were performed with a 64 and 16 slice scanner. We studied the morphological characteristics of the tumor and its resectability. Our data were analyzed with office 2007 and SPSS 22 statistics. We performed the Fischer test with a threshold value below 5%. *Results*: the tumor was of cephalic site in 76.7% of cases with a typical scanographic aspect that was hypodense at pancreatic time in 93.3% of cases. The average tumor size was 37 mm, 6.7% of patients had a tumor size less than 20 mm, 36.7% had a size between 20 and 30 mm and 56.7% had a size greater than 30 mm. Dilation of bile duct and IHBD was noted in 76.6% of patients and dilation of Wirsung in 80% of patients. Arterial contact was noted in 33.3% of patients, venous contact in 46.7% and retro-portal blade was invaded in 23.3% of cases. Liver metastases occurred in 43% of patients and peritoneal carcinosis in 30%. The tumor was resectable in 20% of patients, limited resectable in 6.6%, locally advanced in 13.3% and metastatic in 60%. *Conclusion*: The CT made it possible to accurately characterize and assess the vascular and remote extension of pancreatic tumors that were potentially resectable in only 20% of patients.***

Keywords: pancreatic cancer, CT, resectability

1. Introduction

Fourth cause of mortality from cancer and second cause of mortality from digestive cancer after colorectal cancer [1]. Pancreatic cancer is a poor prognosis with an overall survival of less than 3% at 5 years, mainly due to delayed diagnosis and delicate management [2].

CT is considered the reference examination for assessing locoregional and metastatic extension. This concept has been reinforced by the arrival of multidetector CT scan with better resolution and multiplanar sections offering the possibility of a fine study. Vascular invasion can thus be analyzed with a sensitivity and specificity that vary, respectively, from 80% to 94% and from 89 to 100% [3, 4].

The aim of our work was to assess the role of the scanner in the diagnosis and resectability assessment of pancreatic tumors.
The specific objectives were to:

- Specify the morphological characteristics of the tumor.
- Look for signs of local-regional and remote invasion.
- Classify patients according to tumor resectability based on the recommendations of the Inca 2019.

2. Materials and Methods

It was a retrospective, cross-sectional, descriptive, bi-centric study over a year from February 1, 2018 to January 31, 2019, conducted at the Aristide Le Dantec University Hospital in Dakar and at the Pikine Hospital.

Included were all patients referred for clinical and/or ultrasound suspicion of pancreatic tumor with a typical scan appearance.
Thirty (30) patients met our criteria, 21 male and 9 females, for a gender ratio of 2.33. The average age was 62.6 years with extremes of 42 and 82 years and a standard deviation of 9.68. At the clinic level, jaundice was noted in 80% of patients with weight loss in 65% of cases, 20% of patients had abdominal pain.

The CT scans were performed with 64 slice Somatom Siemens scanner and 16 slice Siemens Definition AS scanner. Acquisitions were made without and with contrast agent injection at pancreatic time (45 seconds) and portal (70 seconds). The reading was made after importing the images onto a syngovia console by 2 senior radiologists using 3D MPR and MIP modes.
We studied the characteristics of the tumor (location, size, density), the presence of indirect signs (bile dilation, dilation of Wirsung and intra-hepatic bile ducts) and associated signs (parenchymal atrophy, upstream pseudocyst).

We looked for a vascular locoregional extension with type of arterial invasion (defined by contact > 180°), venous invasion (defined by contact > 180° with or without stenosis of more than 50% or thrombosis), retroportal blade extension and metastases.

At the end of our analysis, patients were classified according to tumor resectability, according to the 2019 INCa classification [5].

- Resectable tumor: no metastasis, no arterial extension, venous contact (VMS, VP) absent or <180°.

- Resectable tumor limit: no metastasis, reconstructable venous extension, arterial contact <180°.
- Advanced local tumor (not resectable): No metastasis, no venous extension, arterial contact >180°.
- Metastatic tumor (not resectable): Liver, peritoneum, distant lymph nodes, other.

Our data were entered and analyzed with the office 2007 and SPSS 22 statistics software; we performed the Fischer test with a threshold value below 5%.

3. Results

3.1. Morphological characteristics of the tumor

The pancreatic tumor was located at the head in 76.7% of patients, the body in 10% and the tail in 13.3% of patients. The average tumor size was 37 mm with extremes of 12 mm and 70 mm. The size was greater than 30 mm in 56.7% of patients, between 20 and 30 mm in 36.7% and less than 20 mm in 6.7%. The tumor was hypodense at pancreatic time (45 seconds after contrast injection) in 93.3% of cases (**Figure 1**).

As indirect signs, dilation of the bile duct and intra-hepatic bile ducts were noted in 76.6% of patients. In the case of a cephalic site, 91.7% of patients had dilated bile duct and intra-hepatic bile duct. Wirsung was dilated in 80% of patients and in 95.7% of patients with a cephalic site.

Signs associated with the type of upstream pseudocyst were noted in 3.3% of patients and parenchymal atrophy in 54.6% of patients.

3.2 Locoregional invasion and remote extension

Vascular contact was noted in 60.7% of patients with a tumor size greater than or equal to 20 mm.
Ten (10) patients (33.3%) had arterial contact involving the superior mesenteric artery in 35.71% (**Figure 3**). There was a sheathing of less than 180° in 6 patients (20%) and more than 180° in 4 patients (13.3%). The distribution of patients by artery is shown in **Figure 2**.

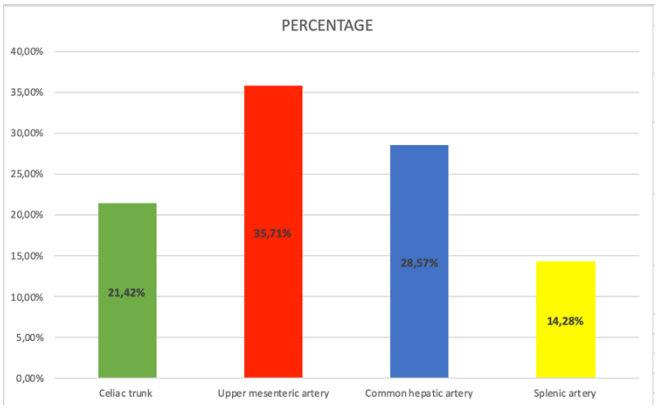

Figure 2: Distribution of patients by arteries in contact with the tumor process

Venous invasion was noted in 14 patients, 46.7%, affecting the superior mesenteric vein in 40% of cases. The distribution of patients by type of vein involved is shown in **Figure 4**.

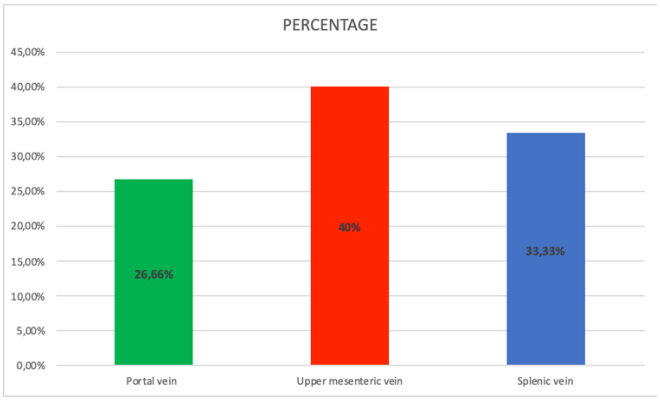

Figure 4: Distribution of patients by vein type in contact with the tumor

A venous sheathing of more than 180° was noted in 5 patients (16.6%) (**Figure 6**) and a venous thrombosis in one patient (3.33%). The distribution of patients by type of venous contact is shown in **Figure 5**.

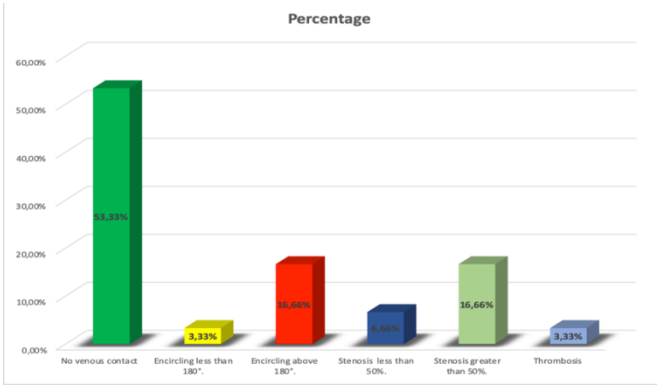

Figure 5: Distribution of patients by type of venous contact

Invasion of the retro portal blade was noted in 23.3% of patients, locoregional adenomegalies in 20% of patients and remote secondary locations (**Figure 8**) in 17 patients (56.6%). The distribution of patients by secondary locations is shown in **Figure 7**.

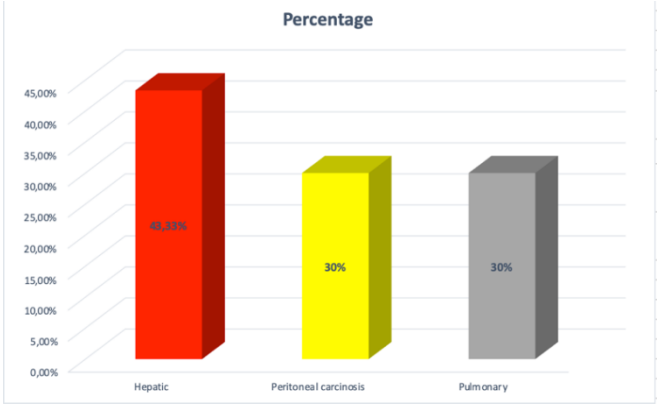

Figure 7: Distribution of patients by location of remote metastases

3.3. Resectability

At the end of the scan, patients were classified according to the tumor resectability shown in **Figure 9**.

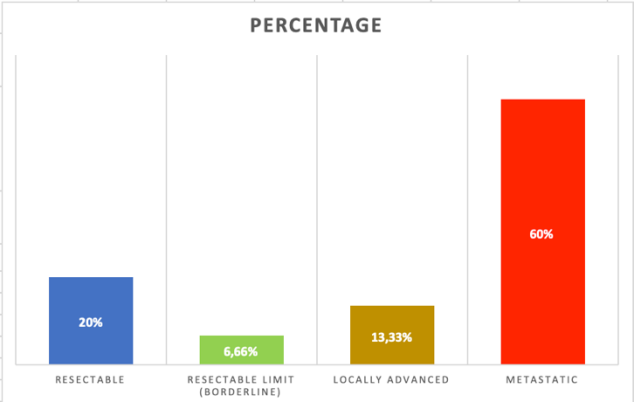

Figure 9: Distribution of patients by resectability of pancreatic tumor

4. Discussion

4.1. Morphological characteristics of the tumor

Our study confirmed the predominance of the cephalic location of pancreatic tumors with 76.7%. This preferential cephalic localization is clearly found in all other series and confirms our results [3].

The mean tumor size was 37 mm with extremes of12 mm and 70 mm. 56.7% of patients had a major axis greater than 30 mm, 36.7% had a tumor size between 20 mm and 30 mm and 6.7% had a major axis less than 20 mm. Tumors smaller than 20 mm are a limit for CT scans and so-called resectable lesions are by definition small [6]. According to Canellas et al, a tumor size greater than 20 mm is a predictive scanning factor of tumor aggressiveness [7].

In our study, 93.3% of lesions appeared hypodense during pancreatic time. The hypodense nature of the lesion is found in 80 to 95% of the most important series [1, 3, 8, 9], with a large minority of tumors remaining isodense in the healthy pancreas. Indeed, pancreatic adenocarcinoma typically results in a hypodense mass at pancreatic time at CT [8, 10].

The density gradient between the tumor and the healthy pancreas is highest at pancreatic time compared to arterial and parenchymal time, resulting in better diagnostic performance of the pancreatic helix in terms of tumor detection [9, 10].

The diagnosis of pancreatic cancer is based on direct and indirect signs. Despite the introduction of helical acquisition, it is not uncommon for only indirect signs to be present [11]. Dilation of the bile duct and intra-hepatic bile ducts was noted in 76.6% of patients and in 91.7% of patients with cephalic tumors. Wirsung dilation was present in 80% of the patients in our series and in 95.7% in case of cephalic tumor. According to Freeny PC et al, dilatation of the bile duct and intra-hepatic bile ducts is noted in 86% of patients with cephalic tumors and dilation of the main pancreatic duct in 88% of patients with cephalic tumors [3]. The association of the two indirect signs described above produces the classic double-duct sign, which is very suggestive, even when isolated, of the diagnosis of pancreatic cancer. In all cases, it is imperative to follow a pancreatic or biliary ductal dilatation well because its stop level precisely marks the level of the tumor obstacle; this topographical analysis is particularly useful in the case of an isodense tumor by CT [3].

4.2 Locoregional invasion, remote extension and resectability

CT is fundamental for the diagnosis and assessment of pancreatic cancer spread [1, 2, 12, 13]. There is a consensus that a so-called pancreatic helix, starting between 35 and 45 seconds after the injection of contrast, is preferable to a pure arterial helix starting before 30 seconds or a parenchymal helix starting at 70 seconds [14, 15]. The best enhancement of the upper mesenteric venous axis; while the arterial structures are still significantly enhanced, allows a complete vascular extension assessment and partly explains this choice of an arterioportal or pancreatic helix. The analysis is even more sensitive thanks to the use of multiplanar reconstructions [16, 17]. In our series, CT had detected venous contact in 46.7% of patients and arterial contact in 33.3%. Vascular contact was noted in 60.7% of patients with a tumor size greater than or equal to 20 mm.

The Bipat meta-analysis [18] found a sensitivity of 91% and a specificity of 85% for vascular evaluation. The results were better for venous involvement with 92% sensitivity and 100% specificity than for arterial involvement with 79% sensitivity and 99% specificity, however the NPV was excellent evaluated at 99% [19].

In our study, 20% of patients had an arterial sheathing of less than 180°, making the tumor considered to be at the edge of resectability or "bordeline". Indeed, even if the resection is technically feasible, the risk of a R1 or even R2 resection is very high. In case of a sheathing of more than 180° (13.3% of the patients in our study), the tumor should be considered locally advanced and any attempt at primary resection is contraindicated. The circumferential sheathing does not necessarily lead to a reduction in arterial size [11].

The direct signs of venous extension are tumor thrombosis or sheathing greater than 180° found in 20% of the patients in our study. On the other hand, an extension of less than 180° is associated with a low risk of flooding, it is often an extension by contiguity [20, 21]. This is not a contraindication to resection. Indeed, 20 to 30% of the resected veins in this case do not present histological invasion but only inflammatory lesions [11].

Apart from thrombosis and sheathing greater than 180°, parietal irregularity has a high specificity, close to 100% [22, 23].

The extent of contact, over more than 2 cm, would be a predictive factor of invasion in 78% of portal vein, and in 81% of upper mesenteric vein [24]. Tumor stenosis is less

specific because a mass effect of the tumor without invasion is frequent. In some specialized centers, very short (less than 2 cm) and loose stenosis is not an absolute contraindication to an exeresis procedure, provided that the venous involvement does not extend to the convergence of the jejunal veins (which is observed mainly in pancreatic hook tumors) [25].

However, in the event of circumferential venous invasion and a fortiori in the presence of a cavernoma (the cavernoma makes the approach to the pancreas hemorrhagic), resection is usually contraindicated due to technical difficulties, frequent invasion of the retroportal blade and/or mesentery root preventing the performance of an R0 exeresis [11, 26, 27].

In the study by Ishikawa and al [28], no patient with pancreatic resection with invasion more than 180° beyond the portal vein or 1-2 cm in length survived beyond 18 months.

In our series, 23.3% of patients had an invasion of the retro-portalblade. The CT scan provides an accurate analysis of the retroportal blade which corresponds to the fatty atmosphere located on the posterior surface of the upper mesenteric vein and which continues along the posterior and lateral right flank of the upper mesenteric artery. The erasure of this space calls into question the resectability and forces the surgeon to first approach the superior mesenteric artery [29]. It is therefore a key site for the locoregional invasion of cephalic pancreatic tumors.

Locoregional adenomegalies were detected in 20% of patients. The sensitivity of CT scans for lymph node invasion diagnosis remains poor, ranging from 54 to 77% [30, 31, 32]. Indeed, only the size criterion is used in CT, with lymph nodes larger than 10 mm of the minor axis being considered invaded. However, it is established that inflammatory lymph nodes can exceed this size and especially that invaded lymph nodes are frequently infra-centimetric. The latter cannot be sufficient and must not lead to a decision of nonresectability. Prenzel et al [33] had shown by analysis of 636 lymph nodes (GG) taken from 52 pieces of cephalic duodeno-pancreatectomy that 86% of GGN1 had a size less than or equal to 10 mm and 46% of GGN0 had a size greater than or equal to 10mm.

In our study, the CT detected hepatic and/or peritoneal metastases in 56.6% of patients. Liver invasion was present in 43% of patients. This extension is well appreciated in CT with an average sensitivity of 75% [31.34]. In a series using helical CT, failure to visualize small hepatic metastases (2 to 10 mm) was responsible for more than 40% of failed resectability diagnosis [11]. The negative predictive value of CT for hepatic invasion is approximately 85% [35]. This is the main limitation of CT in the pre-treatment assessment of pancreatic adenocarcinoma and justifies the systematic use of hepatic MRI in patients with a tumor considered resectable after CT. Indeed, MRI has superior results compared to CT for screening secondary hepatic lesions in pancreatic cancer [36].

Peritoneal carcinosis was present in 30% of patients. The low sensitivity of CT for the diagnosis of early peritoneal carcinosis is well established. However, the surgical discovery of isolated peritoneal metastases, not seen by helical CT in patients operated on for resection, is observed in only 6 to 7% of cases [8, 37]. In practice, peritoneal invasion is very rarely isolated and is accompanied by vascular invasion more easily detected by helical CT [38].

It is essential for the radiologist to know precisely the criteria of non-resectability used by surgeons within his institution. Indeed, these criteria are very different from one center to another. While for some people, an invasion of the peripancreatic fat or the wall of the upper mesenteric vein is still a contraindication to surgical exerese, others go so far as to reconstruct the mesenteric and portal venous axis to remove the tumor. In practice, the formal contraindications to a curative excision procedure accepted by all are the presence of peritoneal carcinosis or liver metastases, an invasion of the celiac trunk, the hepatic artery or the superior mesenteric artery. When the tumor is at the corporeo-caudal site, invasion of the splenic artery is not a formal contraindication to excisional surgery [39].

In our study, the percentage of resectability was estimated at 20%. In the literature, resection rates for pancreatic cancers are very varied from one series to another, Bramhal and al [40] found 2.6% surgical resection, Pascali and al [41] in Italy found 17.7% surgical resection; Moutet and al [42] reported curative surgery in 4.4% of patients.

Indeed, surgical resection is currently the only potentially curative treatment for pancreatic adenocarcinomas. It allows a survival benefit (15 to 25% at 5 years) when the resection is complete [43, 44].

Borderline tumors accounted for 6.6% of the patients in our series and locally advanced tumors accounted for 13.3%. This group of patients may become resectable after effective neo-adjuvant treatment. Preoperative treatment, called induction treatment, includes, after histological confirmation of the diagnosis and possible biliary drainage, systemic chemotherapy, possibly followed by radiochemotherapy, with the aim of "sterilizing" the tumor in contact with the arterial axes and transforming the tumor of limited resectability into a resectable tumor with healthy margins. A very large number of treatments have been evaluated over the past twenty years and have allowed 30-40 % of tumors with borderline resectability to become resectable with a survival after resection comparable to that of tumors that can be resectable immediately. Currently, the most highly evaluated induction chemotherapy is Folfirinox, which after 6 to 8 cures for borderline tumors, achieves secondary resectability rates in the range of 60 to 65%. For patients who cannot receive Folfirinox, there is no consensus on the induction treatment to be proposed. The role of radiotherapy and more precisely of a radiochemotherapy combination is more discussed. Radiochemotherapy (50 or 54 grays combined with Capecitabine) could improve the resection rate R0 and thus remote survival [5].

5. Conclusion

CT allowed us to characterize pancreatic tumors in our study and look for signs of locoregional and remote invasiveness. The only curative treatment being surgical resection, it was only possible at the outset in 20% of patients and 6.6% could have benefited from induction treatment because the tumor was of limited resectability. However, the study of resectability must be done in close collaboration with surgeons. Indeed, CT with injection of contrast at pancreatic time using the MPR and MIP modes is the imaging modality of choice to assess tumor resectability, particularly vascular invasion, with very good sensitivity and specificity.

6. Conflicts of Interest

No conflicts of interest were proclaimed.

7. Contribution of Authors

All the authors brought their contribution.

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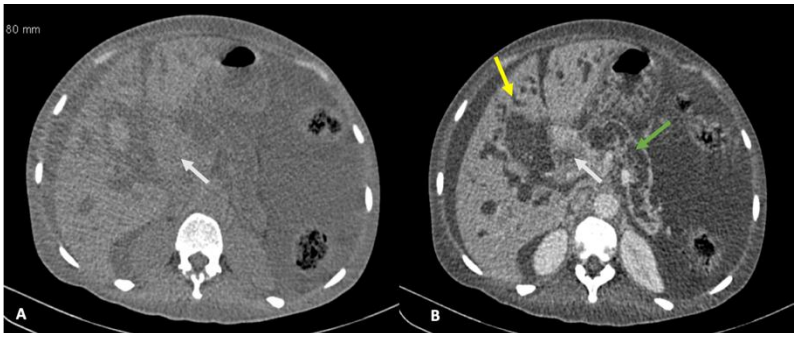

Figure 1: Axial sections of abdominal CT without injection (A) and with injection of contrast (B) showing a spontaneously isodense tumor process of the pancreas head (white arrow) in figure A, slightly elevated at pancreatic time, remaining hypodense (white arrow) in figure B with dilation of Wirsung (green arrow) and intra-hepatic bile ducts (yellow arrow) in a 55 years old patient received for cholestatic jaundice.

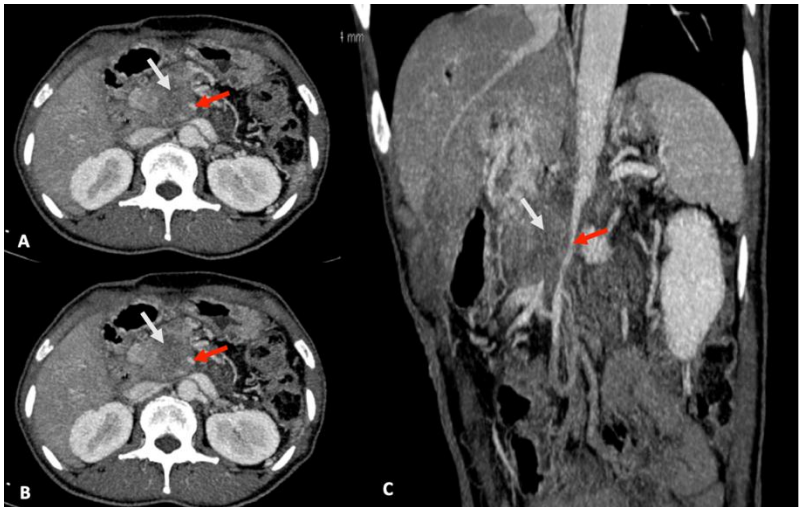

Figure 3: Axial reconstructions in MIP (A, B) and coronal MIP (C) of abdominal CT after contrast injection at pancreatic time showing a tumor process of the pancreatic head (white arrow) appearing hypodense heterogeneous by sheathing the upper mesenteric artery over 180° (red arrow) in a 64 years old female patient received for intense epigastric pain and weight loss.

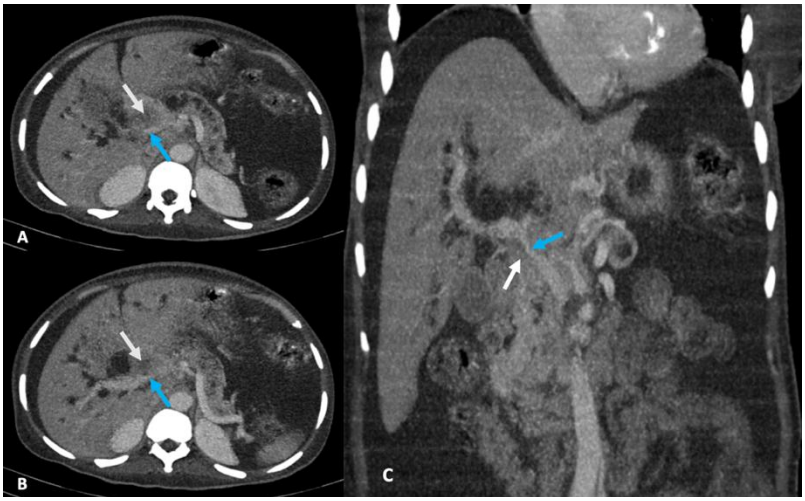

Figure 6: Axial (A, B) and coronal (C) reconstructions in abdominal CT MIP after injection of contrast at portal time showing a tumor process of the pancreatic head (white arrow) with a sheathing of more than 180° of the portal trunk and a significant stenosis greater than 50% (blue arrow) in a 55 years old female patient received for jaundice.

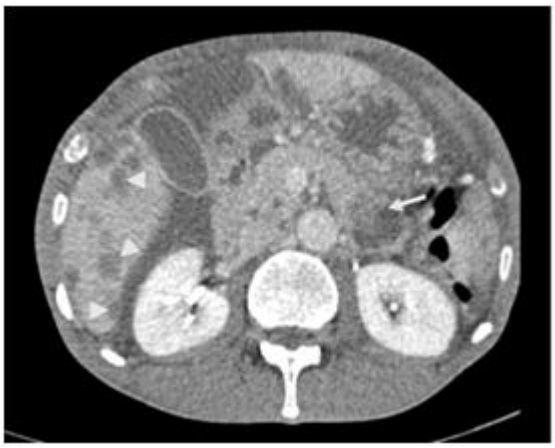

Figure 8: Axial section of an abdominal CT with contrast injection showing diffuse hepatic hypodense images (white arrow heads) related to secondary locations of a tumor of the pancreas tail (white arrow) in a 79 years old patient