MINI REVIEW

Imaging IPMN: Take home messages and news

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Summary

IPMN is a frequent disease involving pancreatic duct. This disease could be malignant (parenchymal invasive adenocarcinoma), particularly if the main pancreatic duct is involved (this involvement is considered present if > 6 mm), if this enlargement reaches 10 mm or more, and if the pathological phenotype is biliopancreatic or intestinal (malignancy is less frequent if gastric one). Invasiveness is suspected if hypodense parenchymal lesion is present, particularly near a cystical lesion or MPD, a mural nodule of the wall, or if MPD wall has got a contrast uptake. Mural nodules inside cystic branch duct are associated with in situ grade 3 malignancies. MPD IPMN must be resected to prevent malignancy. The follow-up of isolated branch duct cysts relies upon MDCT and MRI, every two years if lesion is less than 1 cm. Every one year if bigger, particularly if more than to 3 cm.

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Intraductal papillary mucinous tumors of the pancreas (IPMN) are a pancreatic neoplasm originating from the mucinous epithelium of the pancreatic duct (main duct or branch ducts) (Fig. 1) characterized by papillary growth and mucinous secretions in variable amounts causing ductal dilatation. Depending on the degree of dysplasia, IPMNs may be benign (G1 and G2) or malignant (G3 or invasive) [1].

Malignancy can occur in 30 to 88% of patients, as in situ or invasive carcinomas. The prognosis of malignant IPMN is similar to that of pancreatic adenocarcinoma when there is invasion [2]. Several papers have shown distinctive criteria to differentiate benign and malignant tumors. Some study has focused on differentiating in situ and invasive carcinoma, two entities that are clearly different in pathological studies and with different prognoses. In situ carcinoma (G3) is confined to the ductal structure and appears as an intraductal nodule or lesion surrounded by a sharp margin created by the ductal wall. Invasive carcinoma infiltrates the pancreatic parenchyma and appears as a badly circumscribed infiltrated parenchymal lesion [3–5].

Concerning preoperative imaging, recent papers are of interest. Presence of mural nodule and dilated MPD seem to be more appropriate indicators for resection than cyst size alone for SB-IPMNs [6] (Fig. 2). The presence of solid nodules, thick enhancing walls and/or septae, a wide (> 1 cm) connection of a side-branch lesion with the MPD and the size of the tumor more than 3 cm are indicative of malignancy in a branch and mixed type IPMN [7].

The addition of MPRs to axial CT images may improve diagnostic performance and decrease interobserver variability of MDCT for the determination of PD communication with macrocystic pancreatic neoplasms and differentiation between IPMN and non-IPMN [8].

MRI is much more sensitive in depiction of branch duct IPMN, particularly for the etiological diagnosis of acute pancreatitis (a sole enlarged branch duct could be responsible, even small). Furthermore MRI is necessary
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Benign branch duct IPMN, thick slice T2 MRCP: multiple cysts, some of them with obvious MPD communication.

before surgery, to precisely depict such enlarged branch ducts [4,9,10]. Three-dimensional MRP showed superior image quality to that of 2D MRP but did not increase the diagnostic accuracy for predicting ductal communication of the lesion [9].

Malignant IPMN is mainly observed in MPD, this duct being involved in main duct type, and mixed type IPMN [11,12].

A main pancreatic duct more than 10 mm, a mural nodule more than 3 mm and an abnormal attenuating area in the adjacent pancreatic parenchyma on CT correlates with malignant disease in main duct and mixed type IPMN [7]. MPD enhancement with MRI is also an indicator of malignancy [13] (Fig. 3).

Malignant IPMNs include in situ and invasive IPMN. Because prognosis differs for the two entities, and because the prognosis of invasive IPMN is nearly the same as that of pancreatic carcinoma [2,14], recognition of the two histologic variants is crucial at imaging. The evaluation of the role of CT in distinguishing in situ versus invasive IPMN have reported that mural nodules are mainly observed in in situ IPMN (93%) whereas a pancreatic mass is mainly found in invasive carcinoma (81%). The presence of mural nodules has been reported in 18.5% to 50% of IPMN. A mural nodule of 10 mm is appropriate as an indicator of surgery in the follow-up of branch duct IPMN [15].

In contrast to pancreatic adenocarcinoma, stenosis of the main pancreatic duct is not observed.

Main pancreatic duct malignant IPMN, postintravenous contrast MDCT: marked enlargement (>15 mm) of MPD with 10 mm mural nodule. Disappearance of pancreatic parenchyma surrounding MPD.

The other findings: diameter of the main pancreatic duct and branch ducts, location and presence of calcifications did not differ between in situ or invasive carcinomas.

At present, surgical management is the only cure for malignant IPMN. Preoperative staging is based in part on radiological examination. Although MRI imaging and endoscopic ultrasound are accurate procedures to assess extension of malignant IPMN, computed tomography (CT) is one of the current preoperative procedures. Although inflammation and mucus secretion may make evaluation of vascular encasement difficult, some study shows good accuracy of CT in evaluating malignant IPMN. Criteria in patients with pancreatic adenocarcinoma are currently used to evaluate malignant IPMN. But their value in evaluating IPMN surgical resectability is low because CT overestimates tumor extension to arteries in malignant non-metastatic IPMNs. Even if these two neoplasms are similar, spreading and clinical presentation (especially episodes of recurrent

Malignant branch duct IPMN being more than 3 cm with mural nodule, in the head of the pancreas: a: thick slice T2 MRCP showing grey mural nodule surrounded by hyperintense mucinous content. MPD upstream is moderately enlarged (6 mm); and b: postintravenous contrast MDCT showing enhancement of the nodule.
pancreatitis) differ. Increased attenuation of peritumoral fat is related to inflammatory changes secondary to acute pancreatitis in most. Indeed pancreatitis is more common in IPMN (30%) than in pancreatic adenocarcinoma (3%). This fatty infiltration does not seem to be a contra-indication for surgery [5].

The vascular CT pattern of encasement is one of the most important criteria to evaluate tumor resectability in pancreatic adenocarcinomas and the arterial CT pattern of encasement has been associated with 84% of unresectability. However CT images may correspond to inflammatory reactions or atheromatous stenosis [5]. These vascular criteria seem to be less accurate for evaluating IPMN. The PPV of helical CT as a tool for determining whether a malignant IPMN was non-resectable is low (16.6%, 5). This indicates that CT tends to overestimate non-resectability in patients with malignant IPMN while surgical management is the only curative treatment at present.

Pathological lymph node involvement is present in 33% to 58% with invasive tumors [2,5]. Lymph node involvement in patients with IPMN is less frequent than with adenocarcinoma (76%).

Metastatic lesions are rare at diagnosis as well as peritoneal involvement rarely discovered at surgery, unlike for pancreatic adenocarcinoma.

Extension of IPMN to the digestive or biliary tracts has already been described in 3 to 30% series and can occur in benign or malignant IPMN. Since malignant IPMN with digestive tract or biliopancreatic fistula has a favorable prognosis, surgical resection should not be contra-indicated.

Pancreatic resection must be guided by intraoperative frozen section examination in all patients, evaluating extension of pancreatic neoplasm originating from the mucinous epithelium of the main pancreatic duct [16]. The main limitation of using frozen section during surgery is the existence of discontinuous ("skip") lesions, which account for approximately 10% of IPMN in surgical series and can lead to reoperation in up to 8% of cases [17].

After surgical resection of malignant IPMN, the risk factors associated with recurrence of IPMNs is invasive pathology, elevated carbohydrate antigen 19-9, and main location in the pancreatic head. The recurrence rate of 12.6% is associated with invasive carcinoma. The mean post-operative survival was 17.0 months in the recurrence group and 41.4 months in the non-recurrence group (P < 0.001). A more careful follow-up is needed for such patients [18–20].

To sum up, recommendations of follow up concerning non-operated branch duct IPMN, after a first extensive exploration associating MDCT + MRI + EUS, could be as follow (MRI is not associated with radiation exposure) [6,21–23]. And surgery must be performed if:

- MPD more than 10 mm if isolated or associated with mixed type IPMN, are indicative of malignancy;
- increasing branch duct is more than 5 mm, with nodule or thick wall confirmed by mean of EUS;
- solid nodules, thick enhancing walls and/or septae, a wide (> 1 cm) connection of a side-branch lesion with the MPD, all these particularly if size of the tumor is more than 3 cm [24];
- symptomatic patients, i.e. acute pancreatitis [12,22].

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References

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