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Research Article

The importance of radiological methods in the diagnosis of pancreatic carcinoma, experience at University Clinical Centre of Kosova (2011-2014)

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Abstract: The aim of this paper is to evaluate and to analyze the importance of their imaging methods in diagnosis and stage of pancreatic carcinoma, our experience of imaging characteristics of recently diagnosed pancreatic cancers at University Clinical Center of Kosovo. This is a retrospective research study done during the period of 2011-2015. This retrospective research study includes 97 patients recently diagnosed with pancreatic cancer, examined in the period of 2011-2015 at the University Clinical Center of Kosovo. The imaging diagnostics are performed with Echo- Philips, MSCT Sensation 64 Siemens, MSCT Emotion 6 Siemens, and 1.5T MRI Symphony Siemens, in the Radiologic Clinic of UCCK; while the histopathology diagnostics has been performed in Clinic of Pathology at UCCK. Out of a total of the 97 patients diagnosed with pancreas cancer, 76 cases resulted in head and neck 79.4 % (n=76), 20 cases resulted in body and tail cancers (21%), 1 cases resulted metastasis in pancreas by carcinoma in colon, distant metastases in first imaging modality were found in(n=42) patients 43.3 %, local infiltration was found in patients: gastric infiltration (n=15), duodenal and papilla infiltration (n=26), local infiltration spleen (n=2), local infiltration mesentery (n= 43), dilated biliary tree (n=34), regional lymph node infiltration (n=83). Out of a total of the 97 patients diagnosed with pancreas cancer ,85 cases resulted > 2 cm and 11 cases resulted < 2 cm and with component cystic was 41.2 %(n = 40), solid with component cystic – necrotic 33% (n=32), solid 25.8% (n=25). Seventy-four percent (74%, n=72) of all cancers are found in Stage III and IV. From an imaging point of view, these cancers were presented in an advanced stage, mainly due to their late clinical symptoms and limited access to imaging methods in our country.
Keywords: Pancreatic Cancer, MSCT, MRI, Distant Metastasis, Local Infiltration, University Clinical Center of Kosovo, Prishtina, Kosovo.

INTRODUCTION

Pancreatic cancer is the 10th most common malignancy and the 4th largest cancer killer in adults [1]. The accurate characterization of pancreatic neoplasm is very important for patient's management. CT and MRI have been become the most important modalities for evaluating pancreatic lesions. Precise diagnosis of pancreatic neoplasm is not always straight forward because they frequently show atypical imaging features and many other diseases may mimic pancreatic adenocarcinoma [2, 3,].

PC is the fourth leading cause of cancer-related death in Kosovo. Pancreatic neoplasm have always been associated with a poor prognosis due to the late presentation, and hence, advanced stage of the disease at moment of the established diagnosis. Although this trend is gradually on the decline with the awareness of the existence of these disease, better radiologic imaging modalities for diagnosis in our country, diagnosis of this disease is still made in late stages and prognosis of disease is poor [4].

PC remains one of the deadliest cancers worldwide, and has a poor, five-year survival rate of 5%. Although complete surgical resection is the only curative therapy for pancreatic cancer, less than 20% of newly-diagnosed patients undergo surgical resection with a curative intent. Due to the lack of early symptoms and the tendency of pancreatic adenocarcinoma to invade adjacent structures or to metastasize at an early stage, many patients with pancreatic cancer already have advanced disease at the time of their diagnosis and, therefore, there is a high mortality rate [5].

The estimated lifetime risk of developing pancreatic cancer is about 1 in 71 (1.41%) [6]. The

disease is rare before age 45 but incidence rises rapidly after that and peaks in the seventh decade of life. The major risk factors include smoking [7], hereditary predisposition to pancreatic cancer itself or to multiple cancers [8] and to a lesser degree, chronic pancreatitis [9]. Pancreatic cancer does not exhibit early symptoms and initial symptoms are often nonspecific. Classical presentation of pancreatic cancer is present in only 13-18% of the patients and is often accompanied by purities, alcoholic stools, dark urine and weight loss [10]. Abdominal pain is present in 80-85% of patients with locally advanced or advanced disease. Acute pancreatitis and new onset diabetes mellitus can often be the initial presentations of PC [11, 12].

In up to 75% of the cases, the tumor is located within pancreatic head mostly sparing the tunicate process. Tumors in the pancreatic head often present early with biliary obstruction. However, tumors in the body and tail can remain asymptomatic till late in disease stage. Imaging techniques currently used for diagnosis and preoperative staging of pancreatic cancer include abdominal ultrasound (US), contrast-enhanced computed tomography(CT), magnetic resonance imaging (MRI), MR cholangio pancreatography (MRCP) and invasive imaging modalities like endoscopic retrograde cholangio pancreatography (ERCP) and endoscopic ultrasound (EUS). With the continuing substantial improvements in CT technology, the capacity of MDCT for the detection, diagnosis, and local staging of pancreatic cancer has increased. MDCT is very effective for detecting and staging adenocarcinoma, with a sensitivity of up to 90% for detection and an accuracy of 80%-90% for staging [13, 14]. Determination of the extent of vascular involvement is usually made by identifying the extent to which the tumor involves the cross-sectional circumference of a vessel.

Pancreatic tumors that originate primarily in the pancreas can be epithelial or nonepithelial, can arise in the exocrine or endocrine pancreas, can appear cystic or solid, or can be secondary .The triple role of MRI in evaluating pancreatic neoplasms is tumor detection, characterization, and staging.

The aim of this paper is to evaluate and to analyze the importance of their imaging methods in diagnosis and stage of pancreatic carcinoma, our experience of imaging characteristics of recently diagnosed pancreatic cancers at University Clinical Center of Kosovo. This is a retrospective research study done during the period of 2011-2015.

MATERIAL AND METHODS

This retrospective research study includes 97 patients first time diagnosed with pancreatic cancer, examined in the period form 2011-2015 in the Clinic of Radiology at University Clinical Center of Kosovo. Only patients that were first time diagnosed with pancreatic neoplasm were included and evaluated in this research. Abdominal ultrasound, MSCT 64 slice Sensation and MSCT 6 slice Emotion was used for CT examination of patients. MRI images are obtained with MRI 1.5T Symphony.

Abdominal ultrasound (US) is widely available, non-invasive, relatively inexpensive imaging modality without contrast associated adverse effects. It is usually performed to rule out choledo cholithiasis and look for biliary dilation in patients who present with jaundice and abdominal pain. The real world accuracy of conventional US for diagnosing pancreatic tumors is 50 to 70% [15]. The results of US are highly operator dependant. In addition, body configuration (adipose tissue), overlying bowel gas and patient discomfort can limit the use of US in evaluating the pancreas. If an initial US excludes choledo cholithiasis in a patient with signs and symptoms to suggest a pancreatic etiology, CT or MRI is commonly used for further evaluation.

Computerized tomography (CT) is the initial comprehensive imaging done in patients with suspected pancreatic cancer. Use of non-contrast CT to evaluate pancreas is limited to patients with renal failure or allergic reactions to iodinated contrast agent used. As the pancreatic tumors are hypo vascular and can be visualized only with contrast imaging, non-contrast CT scans have poor sensitivity and specificity for pancreatic tumors and hence cannot be relied on to make a diagnosis.

CT with Intravenous (IV) Contrast:

Multi detector CT (MDCT) provides very thin slice cuts, higher image resolution and faster image acquisition. This technique allows better visualization of the pancreatic adenocarcinoma in relation to the SMA, celiac axis, superior mesenteric vein (SMV), and portal vein as greater parenchymal, arterial, and portal venous enhancement is achieved when imaging the pancreas with MDCT. This can potentially aid in early detection and accurate staging of pancreatic carcinoma [15, 16]. MDCT with intravenous contrast is, therefore, generally considered as the imaging procedure of choice for initial evaluation of most patients suspected to have pancreatic cancer [17]. It has reported sensitivity between 76%-92% for diagnosing pancreatic cancer [18, 19]. Pancreatic ductal adenocarcinoma is hypo vascular and therefore enhances poorly compared to the surrounding pancreatic parenchyma in the early phase of dynamic CT and gradually enhances with delayed images. As a result, on contrast enhanced CT, pancreatic adenocarcinoma is typically seen as a hypo attenuating area but may occasionally be is attenuating to the surrounding normal parenchyma thereby leading to misdiagnosis. Prokesch *et al.;* l have reported that

indirect signs such as mass effect on the pancreatic parenchyma, atrophic distal parenchyma, and abrupt cut off of the pancreatic duct dilation (interrupted duct sign) are important and should be considered as indicators of tumors when mass cannot be clearly identified on CT [20]. Multiple studies have reported extra hepatic biliary dilation and/or pancreatic duct dilation (double duct sign) as findings suggestive of pancreatic carcinoma [21]. It is also important to be aware of changes to the parenchyma caused by chronic pancreatitis as they can closely mimic the changes due to pancreatic carcinoma and may lead to misdiagnosis. Contrast enhanced MDCT can be used to evaluate local extension, invasion of adjacent vascular structures and surgical respectability with an accuracy of 80 to 90% [22]. However for pre-operative staging, it is limited in detecting liver metastases and early lymph node metastasis [23, 24]. The absolute contra-indications of contrast CT are in patients with renal failure and contrast allergy.

Magnetic resonance imaging (MRI) can be used in imaging for pancreatic cancer in patients with equivocal findings at ultrasound or MDCT. MRI examination of the pancreas is done with intravenous administration of contrast material and gadolinium is the most commonly used agent. Pancreatic cancer is hypo intense on gadolinium-enhanced T1-weighted images in the pancreatic and venous phases because it is hypo vascular with abundant fibrous stroma compared to the pancreatic parenchyma. Tumors appear iso intense on delayed images because of slow wash-in of contrast medium. MRI is commonly used to detect pancreatic cancer when a mass lesion is not identifiable on CT scan. There is however no significant diagnostic advantage of MRI over contrast- enhanced CT (sensitivity of 86% on CT vs. 84% on MRI) [25]. Combining the two tests does not improve upon what is achieved with one test alone. MRI is better at characterizing cystic lesions of the pancreas and can provide some indirect radiological evidence to aid in diagnosis of pancreatic cancer. The choice of MRI or CT usually depends upon available local expertise and the clinician's comfort with one or the other radio-imaging technique. It is contraindicated in patients with metal in the body (e.g.: pacemakers, implants) and contrast allergy.

Magnetic resonance cholangio pancreatography (MRCP) is a useful adjunct to other radiographic diagnostic techniques and may emerge as the preoperative imaging procedure of choice for patients with suspected pancreatic cancer. MRCP uses magnetic resonance technology to create a three dimensional image of the pancreatico biliary tree, liver parenchyma, and vascular structures. MRCP is better than CT for defining the anatomy of the biliary tree and pancreatic duct, has the capability to evaluate the bile ducts both above and below a stricture, and can also identify intrahepatic mass lesions. It is reportedly as sensitive as ERCP in detecting pancreatic cancers and unlike conventional ERCP, does not require contrast material to be administered into the ductal system [26]. Thus, the morbidity associated with endoscopic procedures and contrast administration is avoided. Although MRCP has not yet completely replaced ERCP in patients with suspected pancreatic cancer in all centers, it is routinely used in patients with high grade stenosis of the gastric outlet or proximal duodenum or in those with certain post-surgical anatomy (e.g., Billroth II, Roux-en Y biliary bypass), which make the biliary ductal system difficult to access by ERCP [27]. Chronic pancreatitis can be difficult to differentiate from pancreatic adenocarcinoma on MRI since both show low signal intensity on T1-weighted images and both may be associated with pancreatic and/or biliary ductal obstruction. Dynamic gadolinium-enhanced MRI cannot differentiate chronic pancreatitis and PC on the basis of degree and time of enhancement [28]. MRCP images may be more helpful in distinguishing between chronic pancreatitis and pancreatic adenocarcinoma especially if the duct-penetrating sign signifying a non-obstructed main pancreatic duct is present [29, 30].

Percutaneous Biopsy with MSCT guided percutaneous core- biopsy is first choice modality of sample taking in cases with PC. Prior local anesthetic is administrated and 14G needle true-cut biopsy is performed.

RESULTS

In this study we included only patient first time diagnosed with MSCT or MRI with PC at our institution. There were in total 97 cases. All patients were diagnosed in University clinical center of Kosovo (UCCK). As first diagnostic modality was Abdominal Ultrasound, MSCT in 100% (n=97), MSCT and MRI in same patients 48.5 % (n=47). Out of 97 patients, 67% were males (n=65) and 33% (n=32) females (table.1)

Out of 97 recently diagnosed pancreatic cancers, in 78.4% (n=76) cases is presented in head or neck of pancreas, 20.6% (n=20) cases in body and tail and 1 % (n=1). Table 2.

In most cases imaging presentation of tumors was with cystic component, 41.2 % (n=40), solid component, 25.8 % (n=25), and solid with component cystic – necrotic 33 % (n=32). Table. 3.

Tumor size in time of examination of patients was <2 cm in 11% (n=11), 89% (n=86) was greater than 2 cm. Table 4.

With ductus pancreaticus dilatation was found dilated in 42.3% (n=41) , atrophy of body and tail was

found in 26.8% (n=26), biliary obstruction with biliary tree dilatation was presented 35.1 % (n=34). Table .4

Liver metastases are found in 30 % of patients (n=29). Lung metastasis with or without hilar lymphadenopathy was found in 5% (n=5), peritoneal carcinomatosis was found in 7% (n=7), and in adrenal metastatic was found 1% (n=1) , regional lymph node involvement in 85.6% (n=83) of total n=97 cases. Table. 5.6.7.

Most of local infiltration was presented as duodenal (ampular) infiltration, 35% (n=34) patients. In 15.5% (n=15) of patients was found gastric infiltration, in 2 cases 2.1 % (n=2) spleen infiltration and in 43 cases 44.3 % (n=43) local mesenteric infiltration.

Table.1. Age group/ gender

Age group	Gender		Total N (%)
	F	M	
<40	1	3	4 (4.1)
41-50	1	3	4 (4.1)
51-60	7	14	21 (21.6)
61-70	17	23	40 (41.2)
71-80	5	21	26 (26.8)
>80	1	1	2 (2.1)
Total N (%)	**32 (33.0)**	**65 (67.0)**	**97 (100.0)**

Table .2: Localization of pancreatic carcinoma

head and neck	body and tail	meta in pancreas	Total
78.4% (n=76)	20.6% (n=20)	1.0% (n=1)	100% (n=97)

Table 3: Local imaging appearance of pancreatic carcinoma

Local imaging appearance			Total
Cystic	Solid	Solid with component cystico necrotike	
41.2% (n=40)	25.8% (n=25)	33 % (n=32)	100% (n=97)

Table 4: Size of pancreatic carcinoma in diagnosis.

Size	
<2cm	> 2cm
11 %(n=11)	89 %(n=86)

Table 5: Distant metastases of pancreatic carcinoma

Pancreatic carcinoma body and tail with meta in hepar	19.6 %(n=19)
Pancreatic carcinoma head and neck with meta in hepar	10.3%(n=10)
other	70.1%(n=68)

Table.6: Distant metastasis (lung and liver).

Pancreatic carcinoma body and tail with meta in hepar and pulmo	3.1%(n=3)
Pancreatic carcinoma head and neck with meta in hepar and pulmo	2.1%(n=2)
Other	94.8%(n=92)

Table.7: Presence of peritoneal carcinomatosis

Pancreatic carcinoma body and tail with meta in hepar with peritoneal carcinomatosis	5.2%(n=5)
Pancreatic carcinoma head and neck with meta in hepar with peritoneal carcinomatosis	2.1%(n=2)
Other	92.8%(n=90)

Images of pancreatic carcinoma obtained in Our Institution (MRI and MSCT)

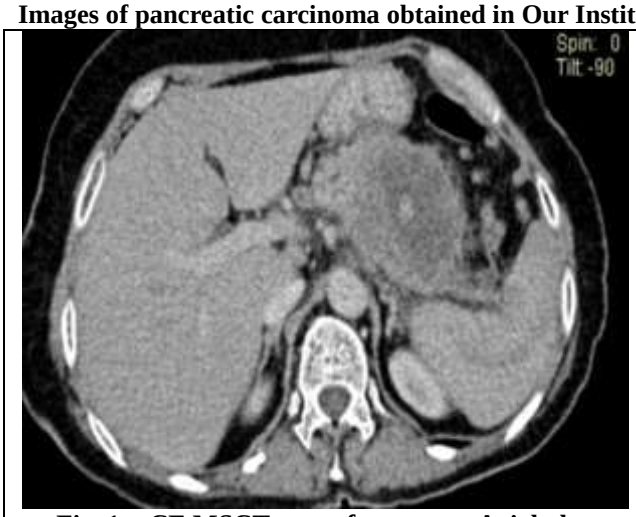


Fig. 1a: CE MSCT scan of pancreas: Axial plane. Expansive process of tail and body of pancreas. Solid mass with cystic and necrotic component.

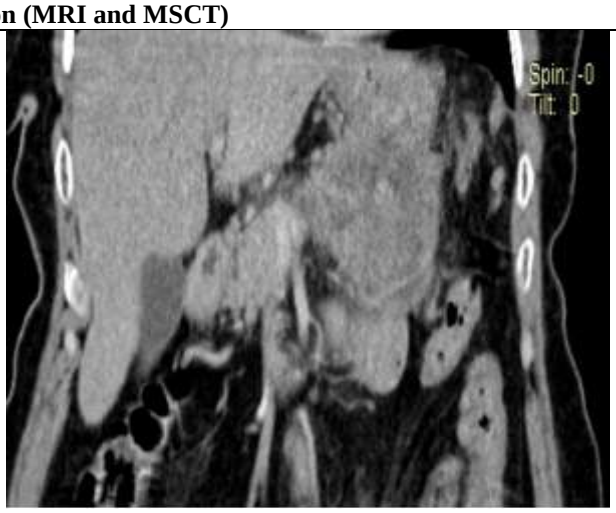


Fig. 1b: CE MSCT scan pf pancreas: Coronal plane. Expansive process of tail and body of pancreas. Solid mass with cystic and necrotic component.

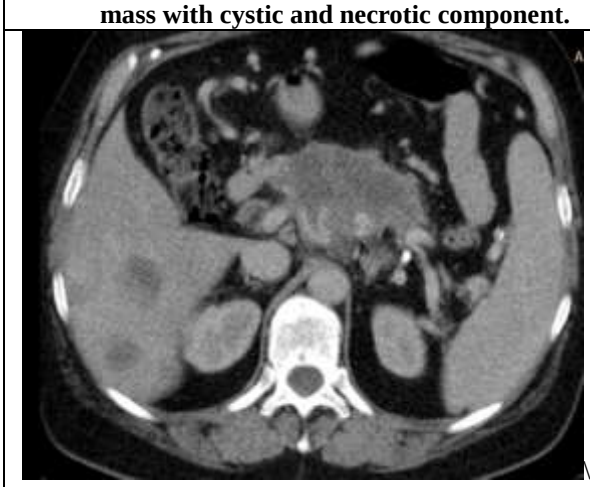


Fig.2a: CE MSCT of upper abdomen: Axial plane: Pancreas body neoplasm with local infiltration of adjacent blood vessel and distant metastases (liver).

Fig.2b: CE MSCT of upper abdomen: Coronal plane: Pancreas body neoplasm with local infiltration of adjacent blood vessel and distant metastases (liver). Cystic and necrotic mass.

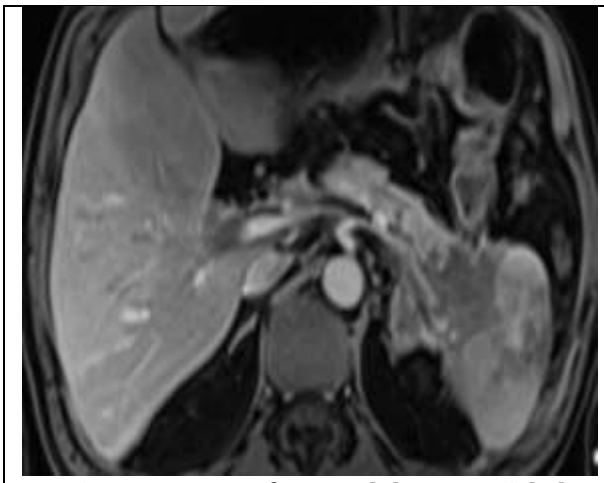


Fig.3a. CE MRI of upper abdomen: Axial plane: Pancreas tail neoplasm with infiltration of spleen and liver metastases.

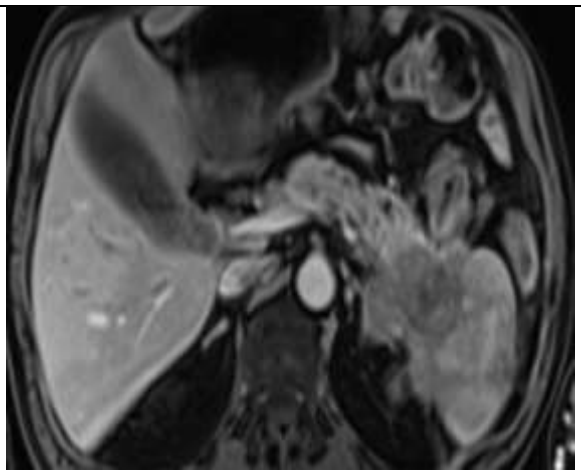


Fig.3b. CE MRI of upper abdomen: Axial plane: Pancreas tail neoplasm with infiltration of spleen and liver metastases.

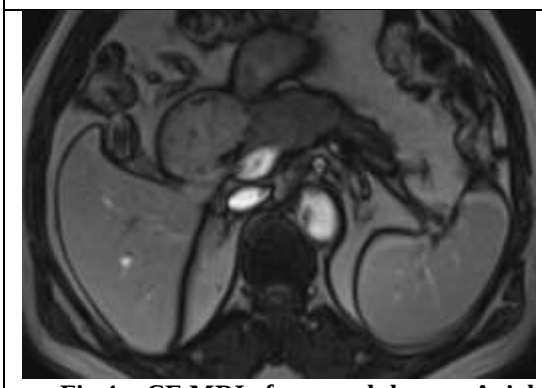


Fig.4a: CE MRI of upper abdomen: Axial plane : Pancreas head and neck neoplasm with dilatation of ductus pancreaticus and atrophy of body and tail

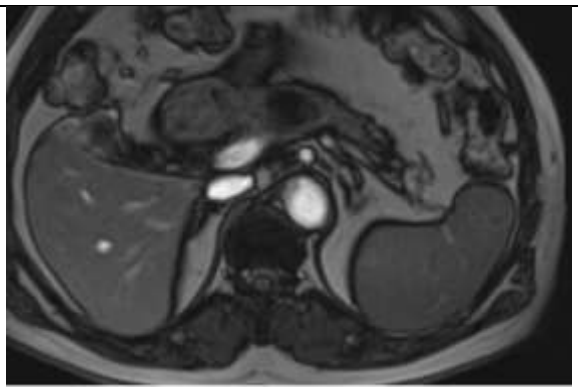


Fig.4b: CE MRI of upper abdomen: Axial plane : Pancreas head and neck neoplasm with dilatation of ductus pancreatic us and atrophy of body and tail

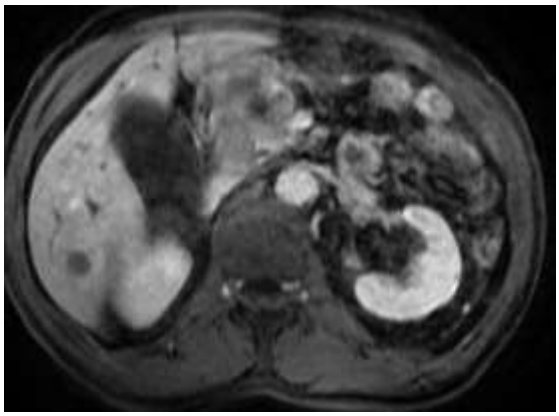


Fig.5a: CE MRI of upper abdomen: Axial plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in duodenum , distance metastases (liver)

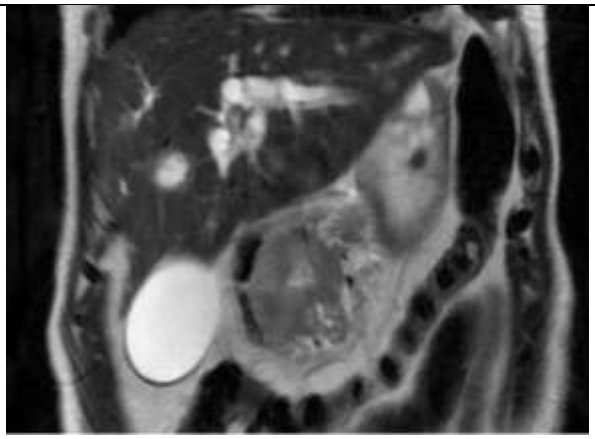


Fig.5b. CE MRI of upper abdomen: Coronal plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in duodenum, distance metastases (liver).

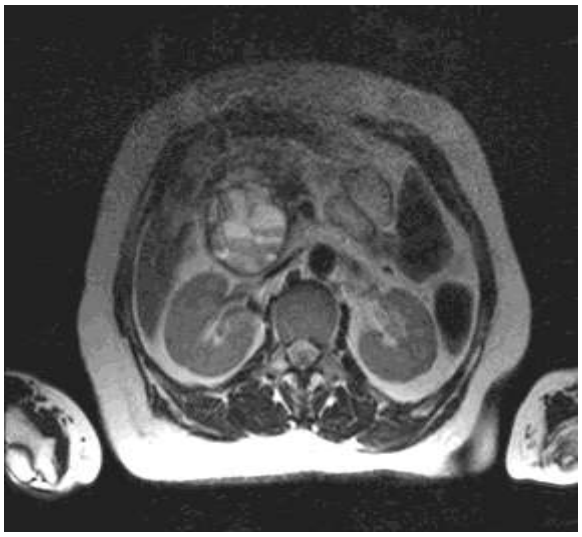


Fig.6a: CE MRI of upper abdomen: Axial plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in duodenum. Cystic component.

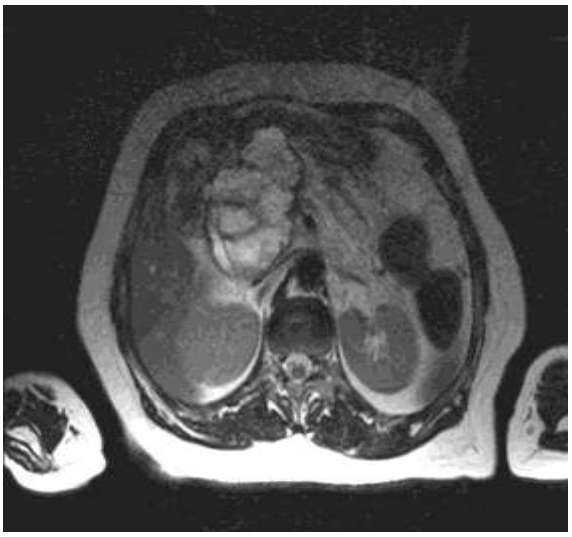


Fig.6b: CE MRI of upper abdomen: Aksial plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in duodenum. Cystic component.

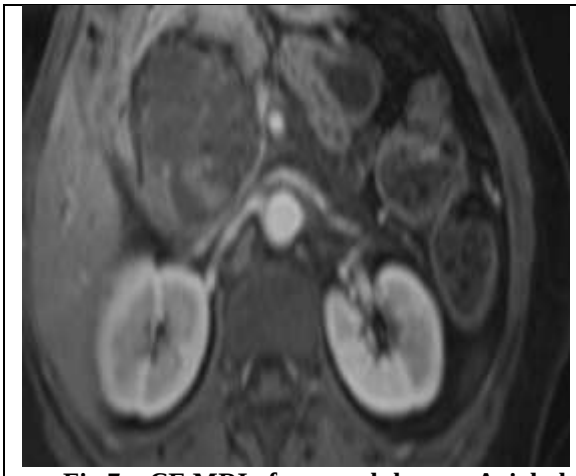


Fig.7a: CE MRI of upper abdomen: Axial plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in duodenum. Cystic component.

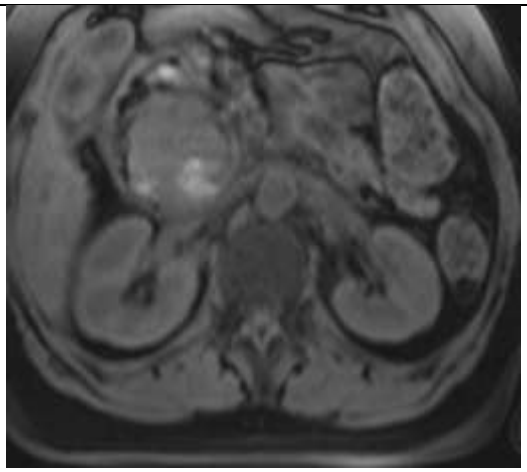


Fig. 7b: CE MRI of upper abdomen: Coronal plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in duodenum. Cystic component.

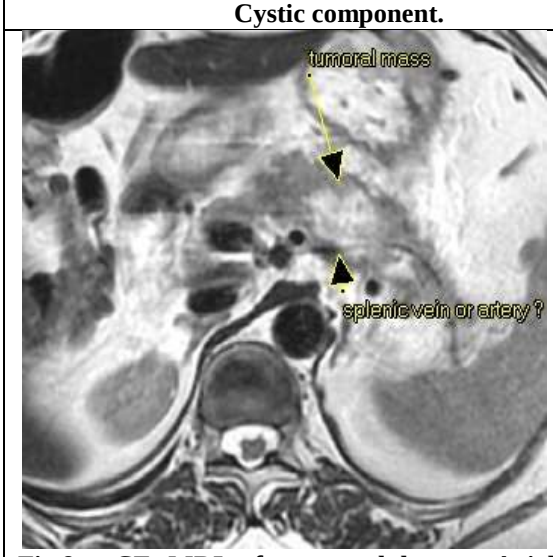


Fig.8a: CE MRI of upper abdomen: Axial plane : Pancreas tail neoplasm with satelit mass in pancreas

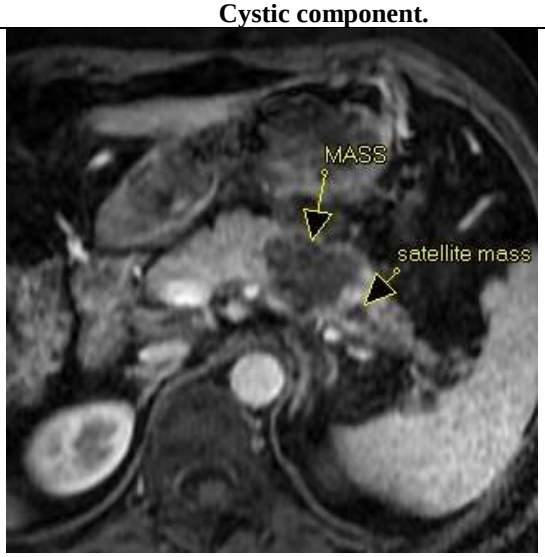
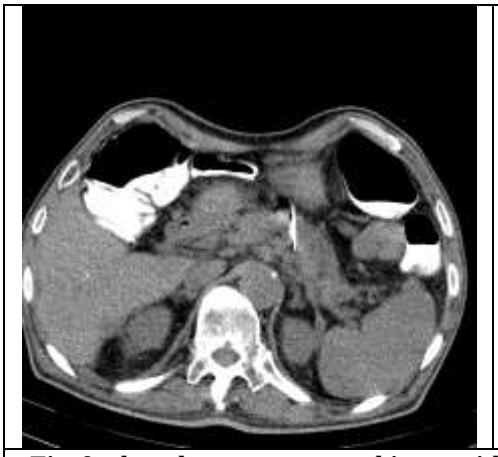
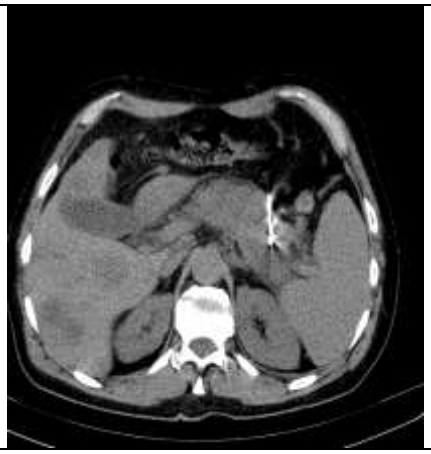


Fig.8b: CE MRI of upper abdomen: Axial plane : Pancreas tail neoplasm with satelit mass in pancreas





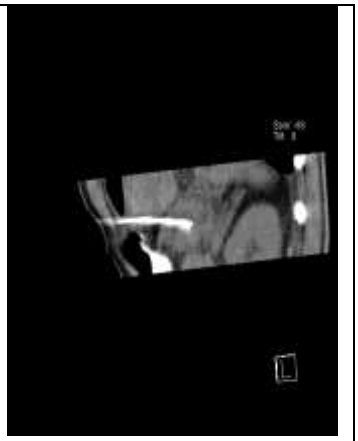


Fig. 9a, b and c. percutaneous biopsy with MSCT of pancreas: Axial and Sagital plane: Pancreas body and tail neoplasm with local infiltration of adjacent blood vessel and infiltration in stomach and with distant metastases (liver)

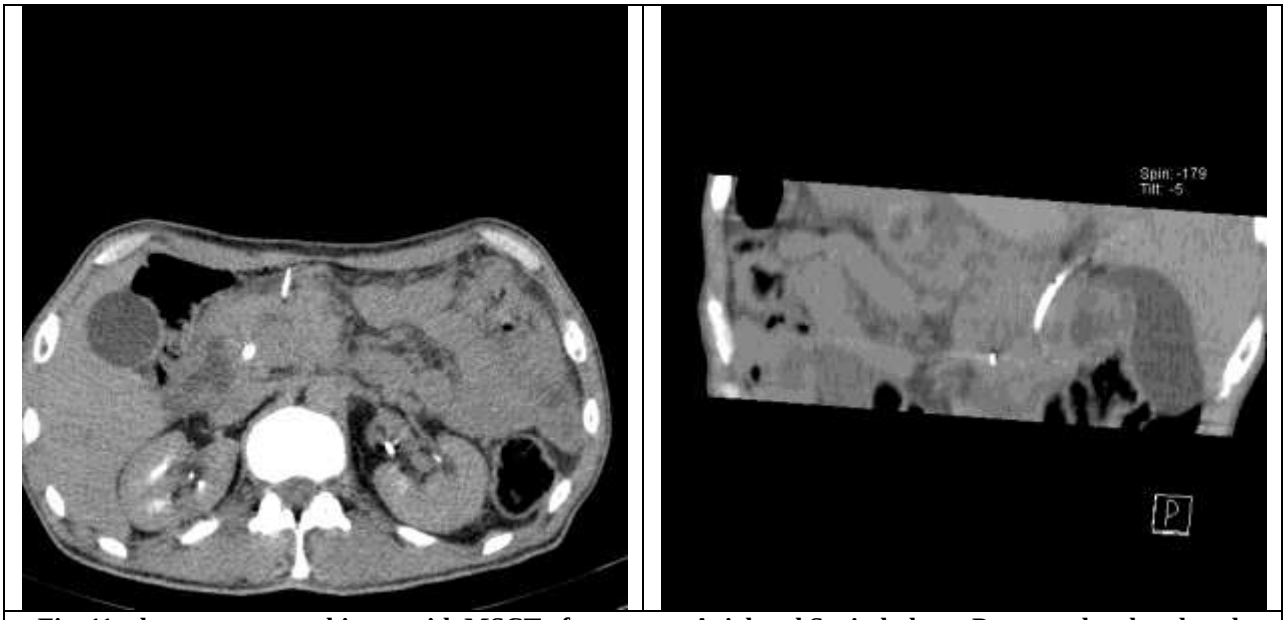


Fig. 11a, b. percutaneous biopsy with MSCT of pancreas: Axial and Sagital plane: Pancreas head and neck neoplasm with local infiltration of adjacent blood vessel and infiltration in stomach with distant metastases (liver).

DISCUSSION

Incidence of PC in Kosovo is increasing, but according to world-wide data it is reaching the incidence of developed countries. This is explained by utilization of advanced imaging modalities in routine examination of patients with complains suspected for pancreatic disease. According to our studies, the M/F ratio is 2:1 (67/30) that is different from similar studies done in European countries (M/F ratio is 1.6:1)[31]. The results obtained in Balkan countries are approximately same as Europeans (M/F is 1.5:1), [32] while resulted statistics in UK are inversed (M/F is 1:1.3) [33] Has to be mentioned that the number of patients included in our last, abovementioned study was 97 - out of overall number of 289 patients examined in previous more comprehensive statistical group (the ratio in this group was M/F is 1.7: 1). As to age/group, all statistics show that the most attached fraction is 61-70 year age group. Even the endoscopic ultrasonography was not included in our examination methods, this did not have significant impact in diagnosis of pancreatic carcinoma[34] The early diagnosis of PC correlates (as in other studies) with Tumor localization – the tumors of the head was easily diagnosed (in contrary to body and tail tumor that were diagnosed in advanced stages). The percentage of cases with nearby and distant metastases (30%) - especially in liver, are similar to the results obtained in other countries [35]. The imaging characteristics are similar at all types of tumors – hypo density in MSCT and hypo intensity MRI. The cases with cystic components that were not totally differentiated in MDCT were examined and diagnosed in MRI due to higher sensitivity. Digital subtraction angiography was not routinely used in our study since most of the examinations of blood vessels that were crucial for staging, were done and diagnosed with the use of MDCT[36]. Despite different difficulties in diagnosis and treatment of pancreatic carcinoma in Kosovo, the statistics of survival rates are similar with statistics in European countries. Survival time in Kosovo is 3-16 months (after 3 years there are only 6 patients still alive – out of 97 that were diagnosed during the period 2011-2015).

CONCLUSION

MDCT is the preferred initial imaging modality in patients with clinical suspicion for pancreatic cancer with 90% specificity and 90% sensitivity. Special emphasis is given to the impact of multi detector CT and post processing imaging techniques on the staging (almost 100 %) of pancreatic adenocarcinoma. The MRI was used for further differentiation of mixed tumors (high sensitivity for cystic component) interchangeably with MRCP that helped in differentiating of pancreatic carcinoma from chronic pancreatitis. MRI plays a triple role in the evaluation of the pancreas: Diagnosis, staging, and detection of complications. The role of MRI has increased, especially in imaging patients with suspected pancreatic neoplasms. Currently, major MRI indications include assessment of neoplasms (especially cystic pancreatic tumors) and evaluation of chronic pancreatitis. It is understandable that the most accurate diagnosis were obtained after percutaneous core biopsy [36, 37, 38]. The combination of different diagnostic imaging methods along with multiple laboratory

analysis and multidisciplinary clinical cooperation was the preferred method for accurate and early diagnosis of PC. We recommend this type of clinical work in order to have best possible results.

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