# MRCP for Cholangiocarcinoma and Viability of Artificial Intelligence to Oncological Care in Pakistan: A Case Report and Literature Review

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

***Article Information***

| *Case Report* |
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## ABSTRACT

**Introduction:** Cholangiocarcinoma (CCA) is a primary malignancy arising from cholangiocytes of the biliary tract. In majority of the cases, late presentations are noted, where there is vascular encasement with perineural and lymphatic invasion. Curative resection with negative tumor margins is a viable option in only 30% patients.
**Objective:** To describe a clinical case of cholangiocarcinoma with respect to the diagnostic radiological perspective and radiomics-artificial intelligence in Pakistan.
**Case Presentation:** A 60 years old male patient visited a tertiary care hospital with complaints of jaundice, weight loss and off and on fever over past few months. On MRCP, moderate intra and extrahepatic biliary dilatation with abrupt, irregular narrowing of proximal common bile duct revealing a 'gloved finger appearance' was documented. The coronal reformatted MRCP imaging findings showed intrahepatic biliary duct dilatation with abrupt irregular cut off at the proximal CBD.

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The diagnostic radiological findings pointed to a malignant stricture, possibly cholangiocarcinoma. On obtaining biopsy proceedings of the suspicious mass, a final diagnosis was made of adenocarcinoma of the common hepatic duct (cholangiocarcinoma). While the patient ultimately underwent surgery at the hospital, there was loss to follow-up post diagnostic radiological/pathological confirmation of the case, and surgical intervention.

**Conclusion:** While we relied on MRCP findings, the conventional imaging choice for CCA, we envision that AI, a novel technique, will be an essential step in radiological diagnosis, oncological prognosis, and surgical treatment options. Radiomics knowledge systems are a technology of the future that will help in primarily identifying, segmenting, and extracting features from regions of interest.

## 1. INTRODUCTION

Cholangiocarcinoma (CCA) is a primary malignancy arising from cholangiocytes of the biliary tract [1]. The disease was previously known as the Klatskin tumor, but the terminology now relies on the type of tumor, central or perihilar [1]. CCA is typically diagnosed in late stages leading to poorer outcomes at the time of presentation [2]. The five-year survival rate of CCA is 7%, whereas the three-year survival rate is 0% without surgical intervention [2]. The bile duct cancer is primarily epithelial in origin, with an incidence of 0.5-1 % among all cancers, and has a strikingly high incidence of 10% out of all primary hepatic malignancies [3]. CCA is the second most common primary hepatobiliary tumor, with the highest cases reported of hepatocellular carcinoma (HCC) [4]. Epidemiological reports identify that men are at a 1.5 fold increased risk of development CCA as compared to women [5]. The curative treatment for CCA is surgical resection, which may only be applicable to lesions that are well localized in nature. However, in a majority of patients, late presentations are common. In cases where there is vascular encasement with perineural and lymphatic invasion, curative resection with negative tumor margins is the only viable option in 30% patients [5].

Given the lack of reports in Pakistan, particularly with respect to the diagnostic radiological perspective and radiomics-artificial intelligence, we decided to perform a literature review on the topic. We report a case of a 60-year-old-man who presented to the outpatient department of a tertiary care hospital with complaints of jaundice-associated symptoms and recent weight loss.

## 2. CASE PRESENTATION

A 60 years old male patient visited a tertiary care hospital with complaints of jaundice, weight loss and off and on fever over past few months. On obtaining informed consent from the patient, the case was compiled for publication. During the first visit, the patient was discharged with symptomatic treatment based on laboratory investigations and ultrasound imaging of the abdomen. During the second visit, the patient presented with temporary relief of symptoms post one week of treatment. The total bilirubin level was raised upto 4mg/dl with no other abnormalities in laboratory investigations. However, on ultrasound imaging studies of the abdomen, we found significantly dilated intrahepatic biliary ducts radiating to the common hepatic duct with an inability to visualize the common bile duct excluding the distal portion. While assessing the rise in bilirubin levels and ultrasound imaging results, a differential diagnosis was made out of firstly, caroli's disease, secondly, common bile duct stone, and thirdly malignant stricture. To narrow down the radiological diagnosis, Magnetic resonance cholangiopancreatography (MRCP) was advised for further evaluation, and to obtain a definite diagnosis. On MRCP, moderate intra and extrahepatic biliary dilatation with abrupt, irregular narrowing of proximal common bile duct revealing a 'gloved finger appearance' was documented [Fig. 1]. The coronal reformatted MRCP imaging findings showed intrahepatic biliary duct dilatation with abrupt irregular cut off at the proximal CBD [Fig. 2]. The diagnostic radiological findings pointed to a malignant stricture, possibly cholangiocarcinoma.
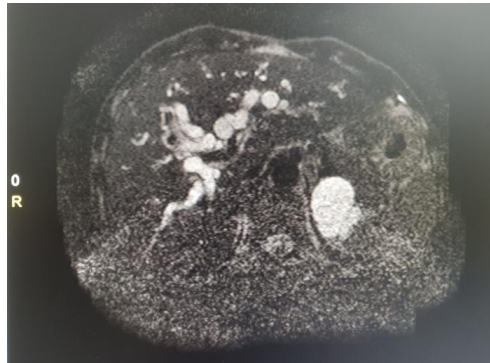
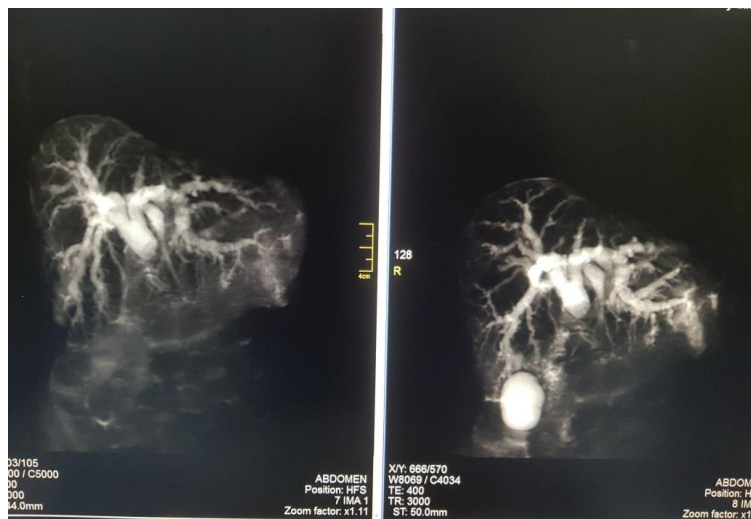**Fig. 1. Axial MRCP image shows intrahepatic biliary duct dilatation**



**Fig. 2. Coronal reformatted MRCP imaging findings showed intrahepatic biliary duct dilatation with abrupt irregular cut off at the proximal CBD**

Henceforth, the patient was sent for a biopsy proceedings of the suspicious mass. The diagnosis was made of adenocarcinoma of the common hepatic duct (cholangiocarcinoma/Klatskin tumor). Post the diagnostic radiological testing and pathological confirmation of the patient's tumor; he was referred to the surgical and oncological departments for tumor resection and chemo-radiotherapy respectively. While the patient ultimately underwent surgery at the hospital, there was loss to follow-up post diagnostic radiological/pathological confirmation of the case, and surgical intervention.

## 3. DISCUSSION AND LITERATURE REVIEW

Cholangiocarcinoma is a diverse group of primary biliary cancers with various anatomical (intrahepatic, perihilar, and extrahepatic) and pathological (mass forming, diffuse, intraductal tubular polypoid and mixed) types [6]. The peak prevalence is in the seventh decade and males are more commonly affected as compared to females, as seen in our case where the patient was a male, aged 60. As far as genetic involvement is concerned, scientific literature reports mutations in the p53 tumor suppressor KRAS gene [7]. From a histopathological perspective, cholangiocarcinoma is a well/moderately/poorly differentiated ductal adenocarcinoma (most common) and papillary or mucinous or mucoepidermoid or adenosquamous with abundant fibrous stroma [8]. Predisposing factors include conditions causing chronic biliary inflammation like inflammatory bowel diseases, biliary lithiasis, primary sclerosing cholangitis and recurrent pyogenic cholangitis. Cholangiocarcinoma is

diagnosed on MRCP/ERCP examinations and further confirmatory tests may be obtained to identify raised serum markers such as CEA and CA 19-9 [9]. As with our case, MRCP was the primary diagnostic investigation of choice that pointed to cholangiocarcinoma findings. Albeit, the final histopathological diagnosis was made post-biopsy of the tumor.

It is also pertinent to assess chemotherapeutic outcomes for CCA; Kumar et al. performed a retrospective analysis based on inpatient data at the Aga Khan University dating 1995-2007 [4]. As with our case, Kumar et al. found that most of the patients who had biliary cancers presented at a late and advanced disease state at the hospital [4]. While a minority of patients received chemotherapy, the responses were highest with capecitbine or cisplatin and gemcitabine combination based therapy [4]. Another pertinent aspect of the Aga Khan University Hospital's study is that 38% patients did not follow-up, while around 54% patients died [4]. Our report raises three concerns. First, for patient neglect in low and middle-income countries, and second, inadequate resources to obtain timely diagnosis, and third, acquiring chemotherapeutic or surgical treatment among the rural Pakistani population.

While gallbladder cancer or cholagiocarcinoma is a common malignancy in Pakistan, very limited data is available in scientific literature to corroborate incidence and prevalence. A scientific report proposed that cholangiocarcinoma evaluation could also be proceeded with artificial intelligence (AI) in addition to regular imaging procedures [5]. In the recent years AI has gained traction and many improvements across healthcare systems in high income countries have been noted, particularly in oncological care and practice [5]. AI may potentially play a pivotal role in the medical field in Pakistan, in the near future [10]. While no national systems have been implemented to address diagnosis of cholangiocarcinoma with AI, it plays an imperative role in firstly drug development, remote monitoring of patients (addressing clinical setbacks during first, second, and subsequent visits as in our case), medical imaging and diagnostics, managing risks, hospital management, and virtual assistance. Majority of AI devices comprise of machine learning techniques in addition to the natural language processing methods. While there are large amounts of imaging techniques, the proposition of AI in Pakistan is in the nascent stage. It must be noted that with the large

amounts of imaging data, in addition to the data on clinical outcomes, the emergence of AI in high-income countries within radiology and by proxy oncology and surgical departments are a rapid developmental area, emerging as "radiomics," a new field of medical research [5]. As with our case, the diagnosis and differential diagnosis of CCA or other tumors in this area is difficult to obtain, as it requires expertise and knowledge due to a variety of overlapping radiological features of every disease. Given the infrastructure and other equipment requires for AI adaptation in Pakistan, the systems may be automated to recognize complex imaging data and provide an objective and quantitative assessment of tumors. Moreover, CCA may be evaluated accurately by combining AI with imaging, oncological, and surgical departments to determine the best clinical management and prognostic evaluation for improved outcomes.

## 4. CONCLUSION

In the immediate future of the Pakistani healthcare system, artificial intelligence (i.e. radiomics) is still an evolving field of imaging that will focus on creating suitable infrastructures in facilitating and developing valid models of care provision. While our report relies on MRCP findings, a conventional imaging choice for CCA, we envision that AI, a novel technique, will be an essential step in radiological diagnosis, oncological prognosis, and surgical treatment options. Moreover, radiomics knowledge systems are a technology of the future that will help in primarily identifying, segmenting, and extracting features from regions of interest. These systems are not only limited to the diagnosis, but also improve the quality of care for patients diagnosed with CCA. In summary, MRCP is an essential imaging technique. While AI is still nascent in high-income countries like the United States, we believe that the role ought to be considered as a viable addition to regular healthcare services across low and middle-income countries like Pakistan. We believe that these synergistic advances in traditional versus AI imaging will make breakthroughs in personalizing and targeting oncological care for cholangiocarcinoma in Pakistan and across the world.

## CONSENT

Authors declare that written informed consent was obtained from the participant for publication of this study and accompanying images.

## ETHICAL APPROVAL

Hereby, all authors declare that all interventions have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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