

World Journal of *Gastroenterology*

World J Gastroenterol 2019 October 7; 25(37): 5578-5731



MINIREVIEWS

- 5578 Pathogenesis and clinical management of *Helicobacter pylori* gastric infection
de Brito BB, da Silva FAF, Soares AS, Pereira VA, Santos MLC, Sampaio MM, Neves PHM, de Melo FF

ORIGINAL ARTICLE**Basic Study**

- 5590 Oncogenic ADAM28 induces gemcitabine resistance and predicts a poor prognosis in pancreatic cancer
Wei L, Wen JY, Chen J, Ma XK, Wu DH, Chen ZH, Huang JL

Case Control Study

- 5604 Correlation of plasma miR-21 and miR-93 with radiotherapy and chemotherapy efficacy and prognosis in patients with esophageal squamous cell carcinoma
Wang WT, Guo CQ, Cui GH, Zhao S

Retrospective Cohort Study

- 5619 Accuracy of an administrative database for pancreatic cancer by international classification of disease 10th codes: A retrospective large-cohort study
Hwang YJ, Park SM, Ahn S, Lee JC, Park YS, Kim N

- 5630 Post-transplant infection improves outcome of hepatocellular carcinoma patients after orthotopic liver transplantation
Chao JS, Zhao SL, Ou-yang SW, Qian YB, Liu AQ, Tang HM, Zhong L, Peng ZH, Xu JM, Sun HC

Retrospective Study

- 5641 Short-term efficacy of robotic and laparoscopic spleen-preserving splenic hilar lymphadenectomy via Huang's three-step maneuver for advanced upper gastric cancer: Results from a propensity score-matched study
Wang JB, Liu ZY, Chen QY, Zhong Q, Xie JW, Lin JX, Lu J, Cao LL, Lin M, Tu RH, Huang ZN, Lin JL, Zheng HL, Que SJ, Zheng CH, Huang CM, Li P

- 5655 Estimating survival benefit of adjuvant therapy based on a Bayesian network prediction model in curatively resected advanced gallbladder adenocarcinoma
Geng ZM, Cai ZQ, Zhang Z, Tang ZH, Xue F, Chen C, Zhang D, Li Q, Zhang R, Li WZ, Wang L, Si SB

- 5667 Soluble mannose receptor as a predictor of prognosis of hepatitis B virus-related acute-on-chronic liver failure
Li TP, Guan SH, Wang Q, Chen LW, Yang K, Zhang H

Observational Study

- 5676 Nonalcoholic fatty liver disease in patients with inflammatory bowel disease: Beyond the natural history
Magri S, Paduano D, Chicco F, Cingolani A, Farris C, Delogu G, Tumbarello F, Lai M, Melis A, Casula L, Fantini MC, Usai P

Prospective Study

- 5687 Long-term outcomes of hepatocellular carcinoma that underwent chemoembolization for bridging or downstaging
Affonso BB, Galastri FL, da Motta Leal Filho JM, Nasser F, Falsarella PM, Cavalcante RN, de Almeida MD, Felga GEG, Valle LGM, Wolosker N

META-ANALYSIS

- 5702 Is there an association between *Helicobacter pylori* infection and irritable bowel syndrome? A meta-analysis
Ng QX, Foo NX, Loke W, Koh YQ, Seah VJM, Soh AYS, Yeo WS
- 5711 Is total laparoscopic pancreaticoduodenectomy superior to open procedure? A meta-analysis
Zhang H, Lan X, Peng B, Li B

ABOUT COVER

Editorial board member of *World Journal of Gastroenterology*, Mortada HF El-Shabrawi, MD, FAASLD, Professor, Department of Pediatrics, Faculty of Medicine, Cairo University, Cairo 11559, Egypt

AIMS AND SCOPE

The primary aim of *World Journal of Gastroenterology* (*WJG*, *World J Gastroenterol*) is to provide scholars and readers from various fields of gastroenterology and hepatology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJG mainly publishes articles reporting research results and findings obtained in the field of gastroenterology and hepatology and covering a wide range of topics including gastroenterology, hepatology, gastrointestinal endoscopy, gastrointestinal surgery, gastrointestinal oncology, and pediatric gastroenterology.

INDEXING/ABSTRACTING

The *WJG* is now indexed in Current Contents®/Clinical Medicine, Science Citation Index Expanded (also known as SciSearch®), Journal Citation Reports®, Index Medicus, MEDLINE, PubMed, PubMed Central, and Scopus. The 2019 edition of Journal Citation Report® cites the 2018 impact factor for *WJG* as 3.411 (5-year impact factor: 3.579), ranking *WJG* as 35th among 84 journals in gastroenterology and hepatology (quartile in category Q2). CiteScore (2018): 3.43.

RESPONSIBLE EDITORS FOR THIS ISSUE

Responsible Electronic Editor: *Yu-Jie Ma*
 Proofing Production Department Director: *Yun-Xiaojuan Wu*

NAME OF JOURNAL

World Journal of Gastroenterology

ISSN

ISSN 1007-9327 (print) ISSN 2219-2840 (online)

LAUNCH DATE

October 1, 1995

FREQUENCY

Weekly

EDITORS-IN-CHIEF

Subrata Ghosh, Andrzej S Tarnawski

EDITORIAL BOARD MEMBERS

<http://www.wjgnet.com/1007-9327/editorialboard.htm>

EDITORIAL OFFICE

Ze-Mao Gong, Director

PUBLICATION DATE

October 7, 2019

COPYRIGHT

© 2019 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

Retrospective Cohort Study

Accuracy of an administrative database for pancreatic cancer by international classification of disease 10th codes: A retrospective large-cohort study

Young-Jae Hwang, Seon Mee Park, Soomin Ahn, Jong-Chan Lee, Young Soo Park, Nayoung Kim

ORCID number: Young-Jae Hwang (0000-0003-3979-711X); Seon Mee Park (0000-0002-5835-2741); Soomin Ahn (0000-0002-2464-0665); Jong-Chan Lee (0000-0001-7862-3257); Young Soo Park (0000-0001-8945-0507); Nayoung Kim (0000-0002-9397-0406).

Author contributions: Hwang YJ collected data, analyzed data and drafted the article; Park SM advised design of the protocol and edited the manuscript; Ahn S performed the pathologic diagnosis; Lee JC advised the protocol and revised the manuscript; Park YS and Kim N designed the protocol, and edited the manuscript; All authors have read and approved the final draft of this paper.

Supported by the National Research Foundation of Korea, No. 2011-0030001.

Institutional review board statement: This study was approved by the institutional review board of the Ethics Committee of Seoul National University Bundang Hospital.

Informed consent statement: Patients were not required to give informed consent to the study because our study was done retrospectively. Data for study were obtained after each patient agreed to treatment.

Conflict-of-interest statement: The authors have no conflicts of interest to disclose.

Young-Jae Hwang, Jong-Chan Lee, Young Soo Park, Nayoung Kim, Departments of Internal Medicine, Seoul National University Bundang Hospital, Seoungnam 13620, South Korea

Seon Mee Park, Department of Internal Medicine, Chungbuk National University College of Medicine and Medical Research Institute, Cheongju 28644, South Korea

Soomin Ahn, Departments of Pathology, Seoul National University Bundang Hospital, Seoungnam 13620, South Korea

Nayoung Kim, Department of Internal Medicine and Institute of Liver Research and Tumor Microenvironment Global Core Research Center, Seoul National University College of Medicine, Seoul 08826, South Korea

Corresponding author: Nayoung Kim, MD, PhD, Professor, Department of Internal Medicine, Seoul National University College of Medicine, Seoul National University Bundang Hospital, 82 Gumi-ro 173 Beon-gil, Seoungnam 13620, South Korea. nakim49@snu.ac.kr

Telephone: +82-31-7877008

Fax: +82-31-7874051

Abstract**BACKGROUND**

Korean National Health Insurance (NHI) claims database provides large-cohort. However, studies regarding accuracy of administrative database for pancreatic cancer (PC) have not been reported. We aimed to identify accuracy of NHI database regarding PC classified by international classification of disease (ICD)-10 codes.

AIM

To identify the accuracy and usefulness of administrative database in PC and the accurate ICD codes for PC with location.

METHODS

Study and control groups were collected from 2003 to 2016 at Seoul National University Bundang Hospital. Cases of PC were identified in NHI database by international classification of diseases, 10th revision edition (ICD-10 codes) supported with V codes. V code is issued by medical doctors for covering 95% of medical cost by Korean government. According to pathologic reports, definite or possible diagnoses were defined using medical records, images, and pathology.

Data sharing statement: To gain access to data, data requestors will need to sign a data access agreement. Proposals should be directed to the Ethics Committee of Seoul National University Bundang Hospital.

STROBE statement: The guidelines of the STROBE statement have been adopted.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Manuscript source: Unsolicited manuscript

Received: July 22, 2019

Peer-review started: July 22, 2019

First decision: August 27, 2019

Revised: September 3, 2019

Accepted: September 11, 2019

Article in press: September 11, 2019

Published online: October 7, 2019

P-Reviewer: Caputo D, Sun SY

S-Editor: Tang JZ

L-Editor: A

E-Editor: Ma YJ



RESULTS

A total of 1846 cases with PC and controls were collected. Among PC, only 410 (22.2%) cases were identified as specific cancer sites including head in 234 (12.7%) cases, tail in 104 (5.6%) cases and body in 72 (3.9%) cases. Among PC, 910 (49.3%) cases were diagnosed by definite criteria. Most of these were adenocarcinoma (98.0%). The rates of definite diagnosis of PC were highest in head (70.1%) followed by body (47.2%) and tail (43.3%). False-positive cases were pancreatic cystic neoplasm and metastasis to the pancreas. In terms of the overall diagnosis of PC, sensitivity, specificity, positive predictive value, and negative predictive value were 99.95%, 98.72%, 98.70%, and 99.95%, respectively. Diagnostic accuracy was similar both in terms of diagnostic criteria and tumor locations.

CONCLUSION

Korean NHI claims database collected according to ICD-10 code with V code for PC showed good accuracy.

Key words: Korean national health insurance; Accuracy; Pancreatic cancer; International classification of disease; Sensitivity; Specificity

©The Author(s) 2019. Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: International classification of diseases, 10th revision edition (ICD-10 codes) of pancreatic cancer in an administrative database are acceptable for use for population-based large-cohort studies. To enhance the diagnostic accuracy, we recommend patient identification by the ICD-10 code with tumor location information.

Citation: Hwang YJ, Park SM, Ahn S, Lee JC, Park YS, Kim N. Accuracy of an administrative database for pancreatic cancer by international classification of disease 10th codes: A retrospective large-cohort study. *World J Gastroenterol* 2019; 25(37): 5619-5629

URL: <https://www.wjgnet.com/1007-9327/full/v25/i37/5619.htm>

DOI: <https://dx.doi.org/10.3748/wjg.v25.i37.5619>

INTRODUCTION

Pancreatic cancer (PC) has a very poor prognosis because most are diagnosed at advanced stages, are inoperable state due to invasion of adjacent arteries, or are intractable to chemotherapy^[1-3]. Accurate diagnosis of PC remains challenging despite the widespread use of endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) and biopsy. Therefore, pathological diagnosis of PC is not always possible, and most are diagnosed based on clinical features including image findings, clinical course, and laboratory data.

Location of primary PC is important for prognosis^[4]. Patients with PC in head showed a 5% increased survival benefit as compared with PC in body or tail^[4]. It may be associated with early symptom of PC in the head by obstruction of bile duct or pancreatic duct. Further research is needed about epidemiology and risk factor of PC in body or tail for screening and early diagnosis. If the primary location of PC is well described in database, it might be easier to do research for PC.

Recently, an administrative database has been widely used for medical research^[5-8]. The administrative database includes personal medical information of a large number of the population with long-term follow-up. In addition, administrative database can provide easy access for study of PC location such as identification of information regarding this PC location. For proper interpretation of the results derived from this database, the reliability on the database is critical. Nevertheless, their accuracy in identifying cancer patients for the claims databases collect data for the purposes of reimbursement remains in doubt^[9]. Furthermore, there have been limited studies regarding accuracy and usefulness of the administrative database^[9-11].

The Korea National Health Insurance System (NHIS) contains a complete set of health information pertaining to 50 million members^[12]. The source of the NHIS is the Health Insurance Review and Assessment (HIRA) database, including all insurance claims information of approximately 97% of the Korean population. In this database, the name of the disease is usually coded according to the international classification of

diseases, 10th revision edition (ICD-10 code) published by the World Health Organization^[13,14]. Direct validation for the accuracy between the administrative dataset and NHIS data is impossible because of the Personal Information Protection Act in Korea. Therefore, validation for accuracy and usefulness of diagnostic codes could only be performed at individual hospitals where the diagnosis of each disease was performed and reported to HIRA for insurance claims. Furthermore even though ICD-10 code includes the information for location of PC sometimes it is difficult to define the location of PC. In this situation ICD-10 code without location of PC is used by medical doctors. If current situation is analyzed, it might be good information for approaching the patients with PC.

From this background we aimed to evaluate the accuracy and usefulness of administrative database in PC. To certify the accuracy of diagnosis, we calculated the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of PC by ICD-10 codes compared to controls^[15]. In addition, we aimed to identify the location of PC in detail using ICD-10 codes and electronic medical records (EMR) to define how much the doctors insert the accurate ICD codes for PC with location.

MATERIALS AND METHODS

Data source

From May 2003 to December 2016, cases of PC were retrospectively collected using the Seoul National University Bundang Hospital (SNUBH) Clinical Data Warehouse (CDW)^[16], which was its own database analysis program. The EMR system contains information on the visiting hospital departments, the principal diagnoses and surgical and diagnostic procedures for each patient^[17]. In addition, it includes pathologic results of specimens and imaging modalities, including computerized tomography (CT), endoscopic retrograde cholangiopancreatography (ERCP), EUS, magnetic resonance imaging (MRI), and positron emission tomography (PET)^[3,18-21].

Study population

Information regarding patients, including hospital visit dates, subject characteristics, diagnostic procedures, pathologic results, and surgeries was collected. These information was easily obtained from administrative database. Other hospital medical data were identified through the uploaded database in SNUBH EMR. After approval of the study protocol by the Ethics Committee at SNUBH (IRB number B-1701/378-105), a list of patients with PC according to the ICD-10 code as primary diagnosis was acquired: (1) C25.0-25.3 (malignant neoplasm of pancreas at head, body, tail, and duct, respectively); (2) C25.4 (Malignant neoplasm of endocrine pancreas); and (3) C25.7-9 (malignant neoplasm of pancreas at other parts, overlapping lesion, and unspecified, respectively)^[22]. Then, searched cases were checked as being registered as V codes in the NHIS to confirm diagnostic codes^[23]. The V code is a special code for patients with any ICD-10 cancer codes in South Korea, established by the Korean Ministry of Health and Welfare in 2008. Cancer patients who are registered in the NHIS have issued a V code and are reimbursed at 95% of the medical cost by the Korean government for 5 years. Control cases are defined as individuals without ICD-10 codes for PCs (C25.0-25.9) during the study periods, who experience work-up pathways similar to those of PC, including images (CT, MRI, ERCP, or EUS) and surgery.

Analyzing accuracy of PC diagnosis from administrative database

Medical records of the study and control groups were analyzed to identify definite and possible diagnostic criteria. Definite diagnoses were made according to pathologic reports compatible with PC^[24-26]. Possible diagnoses were made according to image findings, clinical courses, or increased CA 19-9 > 100 U/m compatible with PC^[3,21,27-29]. Typical image finding of PC was defined as focal hypo-attenuated lesions, pancreatic ductal dilation, distal pancreatic parenchymal atrophy, and involvement of the surrounding vascular structures or other organs on radiologic examinations (Table 1 and Figure 1)^[30-32].

In the definite diagnosis group, cancer cell types (adenocarcinoma, adenosquamous carcinoma, or neuroendocrine tumor) and methods of pathologic diagnosis through surgery, endoscopic biopsy or FNA were analyzed (Tables 1 and 2)^[25,33]. In the possible diagnosis group, we examined reports of images (CT, MRI, ERCP, EUS, endoscopy, and PET) by a radiologist or medical records of a physician's reading of the images. We used serum levels of CA 19-9 to differentiate PC from other cancers^[21,29]. To enhance the study reliability, three reviewers carefully examined medical records and compared the final decisions for each case. For discordant cases, they discussed the

Table 1 Diagnostic criteria of pancreatic cancer

Diagnostic criteria	Methods	Positive finding
Definite criteria		
Pathologic analysis	Endoscopy, ERCP, EUS-FNA, Surgery	Adenocarcinoma Mucinous carcinoma Adenosquamous carcinoma Other malignant neoplasm
Possible criteria		
Imaging finding	CT, MRI, ERCP, MRCP, EUS, endoscopy, PET	Focal hypo-attenuated lesion Pancreatic duct dilation Distal pancreatic parenchymal atrophy Involvement of the surrounding vascular structures or other organs
Clinical features	Medical record	Clinical courses compatible with PC
Tumor marker	CA19-9 αFP	> 100 U/mL To exclude other malignancies including hepatocellular carcinoma

CT: Positron emission tomography; MRI: Magnetic resonance imaging; ERCP: Endoscopic retrograde cholangiopancreatography; MRCP: Magnetic resonance cholangiopancreatography; EUS: Endoscopic ultrasound; PET: Positron emission tomography; FNA: Fine needle aspiration; CA19-9: Carbohydrate antigen 19-9; αFP: α-fetoprotein; PC: Pancreatic cancer.

cases and reached consensus. After reviewing medical records and classifying each case, the sensitivity, specificity, PPV, and NPV with 95% confidence intervals (CI) were calculated. We also compared diagnostic power according to cancer sites at the head (C25.0), body (C25.1) and tail (C25.2). In addition, we analyzed patients with ICD 10-code of PC with primary location (C25.0, C25.1, and C25.2).

RESULTS

Characteristics of cases diagnosed as PC by the international classification of diseases, 10th revision edition

A total of 1846 subjects were identified as registered with ICD-10 codes for PC at the SNUBH during the study period (Table 3). Among PC, 1428 (77.4%) cases were registered as unspecified PC, and only 410 (22.2%) cases could be identified with specific cancer sites. PC in the head [234, (12.7%)] was the most common, followed by the tail [104, (5.6%)] and body [72, (3.9%)]. Proportions of PC cases in the pancreatic duct, neuroendocrine tumor, or overlapping were very rare, with only 0.3%, 0.1%, or 0.1%, respectively. Primary cancer location couldn't be identified in patients with C25.9 [1428, (77.4%)]. In these cases with C25.9, we carefully examined all medical records one by one to identify primary cancer location.

Among PC, 910 (49.3%) cases had pancreatic pathologic results associated with the definite diagnostic criteria and classified as definite diagnosis group. Other 936 (50.7%) cases were classified as possible diagnosis group. Pathologic diagnosis was accomplished by surgery in 717 (78.8%) cases, by ERCP or endoscopy in 163 (17.9%) cases, and by EUS-FNA or percutaneous biopsy in 30 (3.5%) cases. Among 1198 cases with serum levels of CA19-9, 684 (57.1%) cases had elevated levels (> 100 UL).

Diagnostic accuracy of PC by the international classification of diseases, 10th revision edition in the administrative database

We analyzed accuracy of ICD-10 codes of PC by definite or possible diagnostic criteria (Table 4). Among 910 cases with pathologic diagnosis, 904 cases satisfied definite diagnostic criteria of PC. Pathologic diagnoses were adenocarcinoma in 886 (98.0%) cases, adenosquamous carcinoma in 3 (0.3%), and neuroendocrine tumor in 15 (1.7%) cases. Six cases who were identified as false-positives, were pancreatic cystic neoplasms, including serous cystic neoplasms, mucinous cystic neoplasms and intraductal pancreatic mucinous neoplasms (Table 3). Among 938 cases with possible diagnoses, 924 subjects satisfied possible diagnostic criteria for PC. Fourteen cases identified as false-positive were pancreatic metastasis from other primary cancers in 6 cases, pancreatic cystic neoplasms in 5 cases, pancreatitis in 2 cases, and accessory spleen in 1 case.

Among 1846 cases of control, only one case of PC was identified (Table 4). This patient underwent distal pancreatectomy because of a pancreatic tail mass and pancreatic ductal dilatation on CT scan. Pathologic diagnosis was invasive carcinoma originating from an intraductal papillary mucinous neoplasm of the pancreas. This

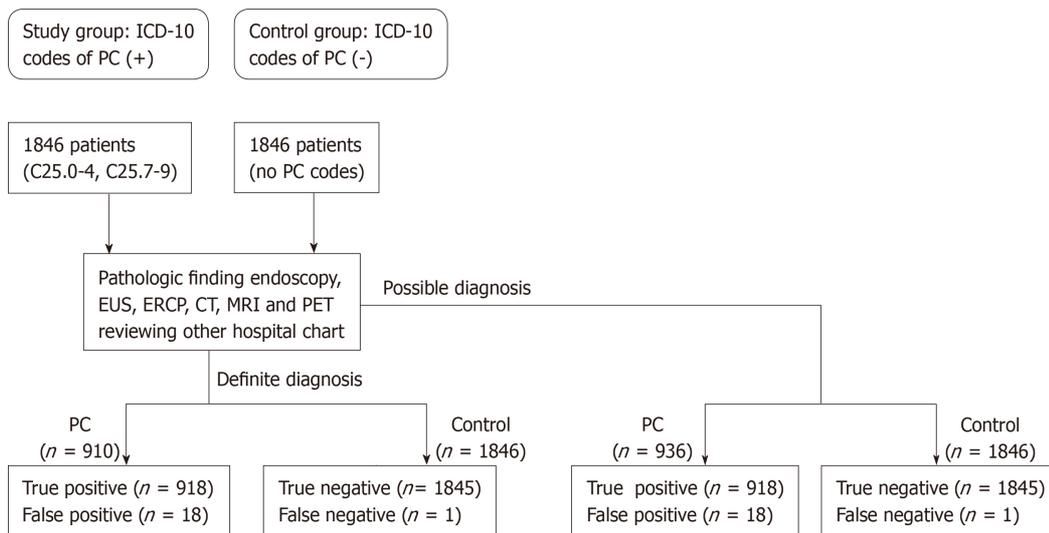


Figure 1 Proposed study algorithm for the inclusion and classification of subjects. ICD: International classification of diseases; PC: Pancreatic cancer; EUS: Endoscopic ultrasound; ERCP: Endoscopic retrograde cholangiopancreatography; CT: Computerized tomography; MRI: Magnetic resonance imaging; PET: Positron emission tomography.

case should be coded as PC; however, it was registered as a benign neoplasm of the pancreas (D13.6)^[34,35].

The diagnostic accuracy of PC differed according to tumor sites (Table 5). The rate of definite diagnosis in the pancreas head was 70.0%, while those in pancreas tail and body were 46.2% and 43.1%, respectively. Incorrect diagnoses including false-positives and false-negatives were 1.4% for pancreatic body cancer, 1.0% for pancreatic tail cancer, and 0% for pancreatic head cancer.

Accuracy of the international classification of diseases, 10th revision edition of PC in the administrative database

Calculated statistical values are summarized in Table 6. For overall diagnostic criteria of PC, the sensitivity and specificity of ICD-10 codes for PC were 99.95% (95%CI: 99.94-99.95) and 98.72% (95%CI: 98.70-98.73), respectively. The PPV and NPV were 98.70% (95%CI: 98.68-98.72) and 99.95% (95%CI: 99.94-99.95), respectively. For definite diagnostic criteria of PC, the sensitivity and specificity of ICD-10 codes for PC were 99.89% (95%CI: 99.88-99.90) and 99.68% (95%CI: 99.67-99.68), respectively. The PPV and NPV were 99.34% (95%CI: 99.32-99.36) and 99.95% (95%CI: 99.94-99.95), respectively. For possible diagnostic criteria for PC, the sensitivity and specificity were 99.89% (95%CI: 99.88-99.90) and 99.03% (99.02-99.05), respectively. The PPV and NPV were 98.08% (98.05-98.11) and 99.95% (99.94-99.95), respectively.

DISCUSSION

This study demonstrated that ICD-10 codes for PC in the administrative database are valid for use in population-based large-cohort studies. Although half of the cases were diagnosed by clinical and radiological features, they showed high diagnostic accuracy. Our results suggest the reliability of previous large-cohort studies using the administrative database in South Korea.

Administrative large databases from various disease registries have been used for population-based studies. However, the quality of a database may be suggested by the quotation of previous studies^[36,37] or by demonstrating similar trends in national estimates^[38] instead of validation of their database. Jon *et al*^[39] studied cancer trends in liver, gallbladder, bile duct, and pancreas in an elderly population in Denmark. They identified cases by ICD-10 codes using the NORDCAN database, widely used in a previous study^[40], without validation.

Previous studies for accuracy of ICD-9 codes revealed that interpretation of administrative databases relying only on ICD-9 codes requires caution. Arous *et al*^[8] identified a total of 1107 PC patients by ICD-9 codes from institutional health care information system (HIS)-linked data sets and surgical databases. They reviewed all patients manually to validate the diagnoses. Analysis regarding pancreatic pathology revealed that 80.3% of patients had true pancreatic neoplasms and 19.7% had other

Table 2 Cancer cell type of pancreatic cancer

	Adenocarcinoma	Adeno-squamouscarcinoma	Neuroendocrinetumor	Total
C250	163	0	1	164
C251	33	0	0	33
C252	45	0	0	45
C253	2	0	0	2
C254	2	0	0	2
C257	1	0	0	1
C259	640	3	14	657
	886 (98.0) ¹	3 (0.3)	15 (1.7)	904

¹Number of patients (%).

pancreatic pathologies. When they used only the HIS-linked dataset, only 36.3% of patients were consistent with pancreatic neoplasms. Friedlin *et al*^[9] compared the diagnostic accuracy of ICD-9 codes and natural language processing (NLP) technology to identify PC in a cohort of pancreatic cysts. They reported that ICD-9 codes achieved lower specificity than did the NLP method (46% and 94%, respectively) in spite of the high sensitivity for identifying PC by both ICD-9 codes and NLP (95% and 84%, respectively).

Our study identified a study group of PC by ICD-10 codes by adding V code using two disease registries, the SNUBH database and the NHIS. Previous population-based large-cohort studies identified cancer populations by both V code and ICD-10 codes^[41,42]. They reported the usefulness of the NHIS database collected by V code in South Korea^[41,42]. Seo *et al*^[42] compared the cancer incidence rates found in the NHIS against in the National Cancer Registry of Korea. The results showed similar overall cancer incidences as well as age-, sex-, and disease-specific rates in both databases.

The reason why we tried to identify the accuracy of ICD-10 code for PC registered in the NHIS in the present study was because the disease entity of PC is difficult to diagnose. We used two disease registries, the SNUBH database and the NHIS, to identify PC cases and controls. We analyzed the diagnostic accuracy according to definite diagnostic criteria in the presence of pathologic reports. Although the rates of pathologic diagnosis were only 49.3%, they achieved a high sensitivity of 99.89%, specificity of 99.68%, PPV of 99.34%, and NPV of 99.95%. These results provide scientific evidence of the results of previous studies using the administrative database. The rates of definite diagnosis and identification of specific cancer sites were higher for pancreatic head cancer ($n = 163$) than for pancreatic body ($n = 33$) or tail ($n = 45$) cancers. These results suggest that pancreatic head cancer is detected earlier and specimens are obtained more easily than for other sites^[28]. In addition, we suggest that it is rather difficult to diagnose pancreatic body or tail cancer, respectively, based on pathologic finding.

Half of the cases registered as PC by ICD-10 codes were validated by possible diagnostic criteria. Because obtaining pancreatic specimens by non-surgical methods is difficult and most would not be candidates for surgery. Only 15-20 percent of patients could be candidates for surgery^[4]. In our study, 717 (38.8%) patients got pancreatectomy. In patients who were not candidates of surgery or procedure because of advanced stages, PC was diagnosed only by clinical, radiologic or serologic features. For the diagnostic accuracy of PC we did not absolutely depend on the level of CA19-9. Instead we used tumor markers of CA19-9 and α FP to differentiate them from other cancer such as hepatocellular carcinoma when image findings and clinical symptoms were insufficient to diagnose PC. Cases registered as PC by ICD-10 codes without pathologic confirmation achieved a high sensitivity of 99.89%, specificity of 99.03%, PPV of 98.08%, and NPV of 99.95%.

We analyzed false-positive and false-negative cases. Cases with incorrect diagnostic pathologic codes were pancreatic cystic neoplasm. Malignant transformation can occur in premalignant pancreatic cystic neoplasm. The differential diagnosis between them is very difficult^[36]. Among cases with possible diagnoses, the wrong diagnosis was caused by pancreatic metastases, pancreatic cystic neoplasm, pancreatitis, or ectopic adjacent organs. PC was difficult to differentiate from invasion, metastasis from adjacent organs or benign cystic lesion.

We found that diagnosis according to cancer sites was not accurate in spite of the high overall diagnostic accuracy for PC. Unspecified PC (C25.9) comprised 77.4% of all PC, and most of the false-positive cases (23 out of 24) were recorded as C25.9.

Table 3 Characteristics of patients with pancreatic cancer according to the international classification of diseases, 10th revision edition

Parameters	N (%)	C250	C251	C252	C253	C254	C257	C259
Number of patients	1846	234 (12.7) ²	72 (3.9)	104 (5.6)	5 (0.3)	2 (0.1)	1 (0.1)	1428 (77.4)
Age at diagnosis	65.22 ± 11.97 ¹	64.72 ± 10.14	63.39 ± 10.48	65.43 ± 11.32	65.20 ± 11.08	70.50 ± 4.95	45.00 ± 0.00	65.39 ± 12.35
Gender (male: Female)	1116:730	150:84	45:27	52:52	1:4	2:0	1:0	865:563
Diagnostic criteria								
Definite	910 (49.3)	164 (70.1)	34 (47.2)	45 (43.3)	2 (40.0)	2 (100.0)	1 (100.0)	662 (46.4)
Possible	936 (50.7)	70 (29.9)	38 (52.8)	59 (56.7)	3 (60.0)	0 (0.0)	0 (0.0)	766 (53.6)
Methods of pathologic diagnosis (n = 910)								
ERCP or endoscopy	163 (17.9)	34 (20.7)	2 (5.9)	8 (17.8)	0 (0.0)	0 (0.0)	0 (0.0)	119 (18.0)
EUS-FNA or percutaneous biopsy	30 (3.3)	4 (2.4)	0 (0.0)	2 (4.4)	0 (0.0)	0 (0.0)	0 (0.0)	26 (3.9)
Surgery	717 (78.8)	126 (76.8)	32 (94.1)	35 (77.8)	2 (100.0)	2 (100.0)	1 (100.0)	517 (78.1)
CA19-9 > 100 U/L								
Yes	684 (37.1)	95 (40.6)	29 (40.3)	44 (42.3)	1 (20.0)	0 (0.0)	0 (0.0)	515 (36.1)
No	514 (27.8)	63 (26.9)	24 (33.3)	23 (22.1)	1 (20.0)	1 (50.0)	0 (0.0)	402 (28.2)
Missing	648 (35.1)	76 (32.5)	19 (26.4)	37 (35.6)	3 (60.0)	1 (50.0)	1 (100.0)	511 (35.8)

¹Median ± standard deviation.²Number (%).

Therefore PC by ICD-10 code adding a V-code in the NHIS data was not sufficient to study cancer sites. For the accurate study regarding primary PC location, we excluded PC patients of C25.9 or examined these patients one by one. If patients with C25.9 are excluded, the advantages of large administrative database disappear. If patients with C25.9 need to be checked primary cancer location individually, the advantage of easy access for medical information is eliminated. Both methods reduce the usefulness of administrative database. So we should try to fill in the ICD-10 codes with primary location of PC. Another weak point of PC coded by ICD-10 in the NHIS data was that it was not adequate for evaluation of neuroendocrine tumors. All neuroendocrine tumors were coded as C25.0 or C25.9, whereas they should be coded as C25.4. Furthermore, two adenocarcinoma cases were coded as C24.4 and should have been coded as C25.4. For the study for accuracy of diagnostic codes in the administrative database, institutions require two conditions: A high burden of cancer patients and a well-established CDW system. SNUBH might be an adequate hospital to perform this study because of its comprehensive EMR system^[8]. SNUBH developed an in-house comprehensive EMR in 2003. The warehouse system provides easy access to diagnostic information for research^[8,16]. In addition, SNUBH is a tertiary referral hospital to which regional hospitals would refer patients; therefore, sufficient numbers of PC cases would be enrolled in this study to enhance the power of the study results. To satisfy statistical requirements ($\alpha = 0.05$, $1-\beta = 0.95$, and effect size 0.1), more than one thousand cases are needed. The size of our study group was sufficient to fulfill the statistical criteria. We provided a new study model for evaluating the accuracy and usefulness of large administrative databases. Many studies using large administrative databases of PC have been done, and our study could support the reliability of these studies^[10,37-40,43]. To enhance the reliability of studies with large administrative databases, our study could be cited as a reference.

Our study has several limitations. One-half of cases were diagnosed by possible diagnostic criteria without pathologic confirmation. Pathologic diagnosis of PC is sometimes impossible because of poor patient conditions and technical difficulty. Therefore, if we adopted only definite diagnostic criteria of PC for accuracy of diagnosis, selection bias could occur. Another limitation was that the study was done only in a single hospital, SNUBH. The diagnostic accuracy might be increased in a tertiary referral hospital rather than a multicenter study. Because most PC cases are treated in referral hospitals in South Korea, we believe that our data may represent the entire PC data of the NHIS in South Korea. In spite of this limitation, our study demonstrated the excellent diagnostic accuracy of the PC data of the NHIS.

In conclusion, ICD-10 codes of PC in an administrative database are acceptable for use for population-based large-cohort studies. To prove reliability of administrative database, we examined subjects dividing two groups, definite and possible diagnosis. In addition, we analyzed both disease registries, SNUBH and NHIS. This study also compared with control group for calculating sensitivity, specificity, PPV and NPV.

Table 4 Diagnostic accuracy of pancreatic cancer diagnosed by the international classification of diseases, 10th revision edition in the administrative database

		Status of PC		Total
		Positive	Negative	
Definite diagnostic criteria				
ICD codes of PC	Outcome positive	True positive 904	False positive 6	910
	Outcome negative	False negative 1	True negative 1845	1846
	Total	905	1851	2756
Possible diagnostic criteria				
ICD codes of PC	Outcome positive	True positive 918	False positive 18	936
	Outcome negative	False negative 1	True negative 1845	1846
	Total	919	1863	2782
Overall diagnostic criteria				
ICD codes of PC	Outcome positive	True positive 1822	False positive 24	1846
	Outcome negative	False negative 1	True negative 1845	1846
	Total	1823	1869	3692

ICD: International classification of disease. PC: Pancreatic cancer.

To identify usefulness of database, we examined cancer location. If researchers could get information of PC site through only ICD-10 code, they can perform the study more easily.

To enhance the diagnostic accuracy, we recommend patient identification by the ICD-10 code with tumor location information and V-code system. From this, we preserved huge administrative database without exclusion. More researches with multiple institutions and various diseases should be needed to practice researches with administrative database.

Table 5 Diagnostic accuracy of pancreatic cancer according to tumor sites by the international classification of diseases, 10th revision edition

ICD codes	Overall diagnosis		Definite diagnosis			Possible diagnosis			
	True (+) ¹	False (+) ²	Total	True (+)	False (+)	Total	True (+)	False (+)	Total
Cell types	234	0	234	164	0	164	70	0	70
C251	71	1	72	30	1	31	41	0	41
C252	104	0	104	48	0	48	56	0	56
C253	5	0	5	2	0	2	3	0	3
C254	2	0	2	2	0	2	0	0	0
C257	1	0	1	1	0	1	0	0	0
C259	1405	23	1428	657	5	662	748	18	766
	1822	24	1846	904	6	910	918	18	936

¹Real cancer patients with ICD 10th codes of cancer.

²No cancer patients with ICD 10th codes of cancer. ICD: International classification of disease.

Table 6 Diagnostic power of international classification of diseases, 10th revision edition for pancreatic cancer

	Overall diagnosis		Definite diagnosis		Possible diagnosis	
	Point estimate (%)	95%CI (%)	Point estimate (%)	95%CI (%)	Point estimate (%)	95%CI (%)
Sensitivity	99.95	99.94-99.95	99.89	99.88-99.90	99.89	99.88-99.90
Specificity	98.72	98.70-98.73	99.68	99.67-99.68	99.03	99.02-99.05
Positive predictive value	98.70	98.68-98.72	99.34	99.32-99.36	98.08	98.05-98.11
Negative predictive value	99.95	99.94-99.95	99.95	99.94-99.95	99.95	99.94-99.95

CI: Confidence interval.

ARTICLE HIGHLIGHTS

Research background

Pancreatic cancer (PC) is usually diagnosed at advanced stages, resulting in the poor prognosis. Large-cohort studies should be performed to evaluate epidemiology and prognosis of PC. However, there are not enough researches about the accuracy of administrative database to avoid coding discrepancies. This study identified accuracy of the administrative large-cohort database of PC. This study is important to support the validation of other large cohort study for PC.

Research motivation

Administrative database was useful for research because of easy access and much information. So, administrative database has been widely used for medical research. However accuracy of the administrative database may be problem. In addition, it was difficult to perform study to identify this. We tried to examine each case and prove accuracy of database of PC. Future study using administrative database of PC should be supported by this study.

Research objectives

We evaluated the accuracy and usefulness of administrative database in PC. In addition, we identified much the doctors insert the accurate ICD codes for PC with location.

Research methods

We evaluated the diagnostic accuracy of PC according to tumor sites from total of 1846 cases with PC and controls. To enhance the study reliability, three reviewers carefully examined medical records and compared the final decisions for each case. After reviewing, we calculated the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). In addition, we analyzed patients with ICD 10-code of PC with primary location.

Research results

Among PC, 1428 (77.4%) cases were registered as unspecified PC, and only 410 (22.2%) cases could be identified with specific cancer sites. For overall diagnostic criteria of PC, the sensitivity and specificity of ICD-10 codes for PC were 99.95% and 98.72%, respectively. The PPV and NPV were 98.70% and 99.95%, respectively.

Research conclusions

We showed accuracy of administrative database of PC in Seoul National University Bundang Hospital. In addition, we identified the location of PC to usefulness of database. Administrative database is useful and important for research. However, validation of database is necessary. From this result, study based on administrative database might be reliable. Future study with administrative database of PC could receive credibility from this result. In addition, this study presented a research method how to identify validation of administrative database.

Research perspectives

We thought that future study involving multiple institutes should be planned. In addition, it is important to gather data in a unified way. We think there is a need for researches for accuracy of administrative database on other diseases. These researches should be necessary for studies based on administrative database.

REFERENCES

- 1 **Molina V**, Visa L, Conill C, Navarro S, Escudero JM, Auge JM, Filella X, Lopez-Boado MA, Ferrer J, Fernandez-Cruz L, Molina R. CA 19-9 in pancreatic cancer: retrospective evaluation of patients with suspicion of pancreatic cancer. *Tumour Biol* 2012; **33**: 799-807 [PMID: 22203495 DOI: 10.1007/s13277-011-0297-8]
 - 2 **Wang W**, Shpaner A, Krishna SG, Ross WA, Bhutani MS, Tamm EP, Raju GS, Xiao L, Wolff RA, Fleming JB, Lee JH. Use of EUS-FNA in diagnosing pancreatic neoplasm without a definitive mass on CT. *Gastrointest Endosc* 2013; **78**: 73-80 [PMID: 23523302 DOI: 10.1016/j.gie.2013.01.040]
 - 3 **Kamisawa T**, Wood LD, Itoi T, Takaori K. Pancreatic cancer. *Lancet* 2016; **388**: 73-85 [PMID: 26830752 DOI: 10.1016/S0140-6736(16)00141-0]
 - 4 **Tomasello G**, Ghidini M, Costanzo A, Ghidini A, Russo A, Barni S, Passalacqua R, Petrelli F. Outcome of head compared to body and tail pancreatic cancer: a systematic review and meta-analysis of 93 studies. *J Gastrointest Oncol* 2019; **10**: 259-269 [PMID: 31032093 DOI: 10.21037/jgo.2018.12.08]
 - 5 **Franchi C**, Giussani G, Messina P, Montesano M, Romi S, Nobili A, Fortino I, Bortolotti A, Merlino L, Beghi E, EPIRES Group. Validation of healthcare administrative data for the diagnosis of epilepsy. *J Epidemiol Community Health* 2013; **67**: 1019-1024 [PMID: 24022813 DOI: 10.1136/jech-2013-202528]
 - 6 **Abraham NS**, Cohen DC, Rivers B, Richardson P. Validation of administrative data used for the diagnosis of upper gastrointestinal events following nonsteroidal anti-inflammatory drug prescription. *Aliment Pharmacol Ther* 2006; **24**: 299-306 [PMID: 16842456 DOI: 10.1111/j.1365-2036.2006.02985.x]
 - 7 **Baldi I**, Vicari P, Di Cuonzo D, Zanetti R, Pagano E, Rosato R, Sacerdote C, Segnan N, Merletti F, Ciccone G. A high positive predictive value algorithm using hospital administrative data identified incident cancer cases. *J Clin Epidemiol* 2008; **61**: 373-379 [PMID: 18313562 DOI: 10.1016/j.jclinepi.2007.05.017]
 - 8 **Arous EJ**, McDade TP, Smith JK, Ng SC, Sullivan ME, Zottola RJ, Ranauro PJ, Shah SA, Whalen GF, Tseng JF. Electronic medical record: research tool for pancreatic cancer? *J Surg Res* 2014; **187**: 466-470 [PMID: 24326179 DOI: 10.1016/j.jss.2013.10.036]
 - 9 **Friedlin J**, Overhage M, Al-Haddad MA, Waters JA, Aguilar-Saavedra JJ, Kesterson J, Schmidt M. Comparing methods for identifying pancreatic cancer patients using electronic data sources. *AMIA Annu Symp Proc* 2010; **2010**: 237-241 [PMID: 21346976]
 - 10 **Beg MS**, Dwivedi AK, Ahmad SA, Ali S, Olowokure O. Impact of diabetes mellitus on the outcome of pancreatic cancer. *PLoS One* 2014; **9**: e98511 [PMID: 24879130 DOI: 10.1371/journal.pone.0098511]
 - 11 **Nieuwenhuis L**, van den Brandt PA. Tree nut, peanut, and peanut butter consumption and the risk of gastric and esophageal cancer subtypes: the Netherlands Cohort Study. *Gastric Cancer* 2018; **21**: 900-912 [PMID: 29594821 DOI: 10.1007/s10120-018-0821-2]
 - 12 **Kim HJ**, Kang TU, Swan H, Kang MJ, Kim N, Ahn HS, Park SM. Incidence and Prognosis of Subsequent Cholangiocarcinoma in Patients with Hepatic Resection for Bile Duct Stones. *Dig Dis Sci* 2018; **63**: 3465-3473 [PMID: 30171402 DOI: 10.1007/s10620-018-5262-6]
 - 13 **Office of the Secretary, HHS**. Administrative simplification: adoption of a standard for a unique health plan identifier; addition to the National Provider Identifier requirements; and a change to the compliance date for the International Classification of Diseases, 10th Edition (ICD-10-CM and ICD-10-PCS) medical data code sets. Final rule. *Fed Regist* 2012; **77**: 54663-54720 [PMID: 22950146]
 - 14 **WHO**. ICD-10: International statistical classification of diseases and related health problems: tenth revision. 2004.
 - 15 **Hwang YJ**, Kim N, Yun CY, Yoon H, Shin CM, Park YS, Son IT, Oh HK, Kim DW, Kang SB, Lee HS, Park SM, Lee DH. Validation of Administrative Big Database for Colorectal Cancer Searched by International Classification of Disease 10th Codes in Korean: A Retrospective Big-cohort Study. *J Cancer Prev* 2018; **23**: 183-190 [PMID: 30671401 DOI: 10.15430/JCP.2018.23.4.183]
 - 16 **de Mul M**, Alons P, van der Velde P, Konings I, Bakker J, Hazelzet J. Development of a clinical data warehouse from an intensive care clinical information system. *Comput Methods Programs Biomed* 2012; **105**: 22-30 [PMID: 20728956 DOI: 10.1016/j.cmpb.2010.07.002]
 - 17 **Yoo S**, Lee KH, Lee HJ, Ha K, Lim C, Chin HJ, Yun J, Cho EY, Chung E, Baek RM, Chung CY, Wee WR, Lee CH, Lee HS, Byeon NS, Hwang H. Seoul National University Bundang Hospital's Electronic System for Total Care. *Health Inform Res* 2012; **18**: 145-152 [PMID: 22844650 DOI: 10.4258/hir.2012.18.2.145]
 - 18 **Lee ES**, Lee JM. Imaging diagnosis of pancreatic cancer: a state-of-the-art review. *World J Gastroenterol* 2014; **20**: 7864-7877 [PMID: 24976723 DOI: 10.3748/wjg.v20.i24.7864]
 - 19 **Callery MP**, Chang KJ, Fishman EK, Talamonti MS, William Traverso L, Linehan DC. Pretreatment assessment of resectable and borderline resectable pancreatic cancer: expert consensus statement. *Ann Surg Oncol* 2009; **16**: 1727-1733 [PMID: 19396496 DOI: 10.1245/s10434-009-0408-6]
 - 20 **Li JH**, He R, Li YM, Cao G, Ma QY, Yang WB. Endoscopic ultrasonography for tumor node staging and vascular invasion in pancreatic cancer: a meta-analysis. *Dig Surg* 2014; **31**: 297-305 [PMID: 25376486 DOI: 10.1159/000368089]
- Huang Z**, Liu F. Diagnostic value of serum carbohydrate antigen 19-9 in pancreatic cancer: a meta-

- 21 analysis. *Tumour Biol* 2014; **35**: 7459-7465 [PMID: 24789274 DOI: 10.1007/s13277-014-1995-9]
- 22 WHO. International statistical classification of diseases and related health problems: tenth revision. 2010.
- 23 Kim SM, Jang WM, Ahn HA, Park HJ, Ahn HS. Korean National Health Insurance value incentive program: achievements and future directions. *J Prev Med Public Health* 2012; **45**: 148-155 [PMID: 22712041 DOI: 10.3961/jpmph.2012.45.3.148]
- 24 Tempero MA, Malafa MP, Al-Hawary M, Asbun H, Bain A, Behrman SW, Benson AB, Binder E, Cardin DB, Cha C, Chiorean EG, Chung V, Czito B, Dillhoff M, Dotan E, Ferrone CR, Hardacre J, Hawkins WG, Herman J, Ko AH, Komanduri S, Koong A, LoConte N, Lowy AM, Moravek C, Nakakura EK, O'Reilly EM, Obando J, Reddy S, Scaife C, Thayer S, Weekes CD, Wolff RA, Wolpin BM, Burns J, Darlow S. Pancreatic Adenocarcinoma, Version 2.2017, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw* 2017; **15**: 1028-1061 [PMID: 28784865 DOI: 10.6004/jnccn.2017.0131]
- 25 Vijgen S, Terris B, Rubbia-Brandt L. Pathology of intrahepatic cholangiocarcinoma. *Hepatobiliary Surg Nutr* 2017; **6**: 22-34 [PMID: 28261592 DOI: 10.21037/hbsn.2016.11.04]
- 26 Wang Z, Chen JQ, Liu JL, Qin XG, Huang Y. FDG-PET in diagnosis, staging and prognosis of pancreatic carcinoma: a meta-analysis. *World J Gastroenterol* 2013; **19**: 4808-4817 [PMID: 23922481 DOI: 10.3748/wjg.v19.i29.4808]
- 27 Chun YS, Pawlik TM, Vauthey JN. 8th Edition of the AJCC Cancer Staging Manual: Pancreas and Hepatobiliary Cancers. *Ann Surg Oncol* 2018; **25**: 845-847 [PMID: 28752469 DOI: 10.1245/s10434-017-6025-x]
- 28 Vincent A, Herman J, Schulick R, Hruban RH, Goggins M. Pancreatic cancer. *Lancet* 2011; **378**: 607-620 [PMID: 21620466 DOI: 10.1016/S0140-6736(10)62307-0]
- 29 Poruk KE, Gay DZ, Brown K, Mulvihill JD, Boucher KM, Scaife CL, Firpo MA, Mulvihill SJ. The clinical utility of CA 19-9 in pancreatic adenocarcinoma: diagnostic and prognostic updates. *Curr Mol Med* 2013; **13**: 340-351 [PMID: 23331006 DOI: 10.2174/1566524011313030003]
- 30 Ahn SS, Kim MJ, Choi JY, Hong HS, Chung YE, Lim JS. Indicative findings of pancreatic cancer in prediagnostic CT. *Eur Radiol* 2009; **19**: 2448-2455 [PMID: 19415290 DOI: 10.1007/s00330-009-1422-6]
- 31 Tanaka S, Nakaizumi A, Ioka T, Oshikawa O, Uehara H, Nakao M, Yamamoto K, Ishikawa O, Ohigashi H, Kitamura T. Main pancreatic duct dilatation: a sign of high risk for pancreatic cancer. *Jpn J Clin Oncol* 2002; **32**: 407-411 [PMID: 12451037 DOI: 10.1093/jjco/hyf093]
- 32 He J, Page AJ, Weiss M, Wolfgang CL, Herman JM, Pawlik TM. Management of borderline and locally advanced pancreatic cancer: where do we stand? *World J Gastroenterol* 2014; **20**: 2255-2266 [PMID: 24605025 DOI: 10.3748/wjg.v20.i9.2255]
- 33 Winter JM, Maitra A, Yeo CJ. Genetics and pathology of pancreatic cancer. *HPB (Oxford)* 2006; **8**: 324-336 [PMID: 18333084 DOI: 10.1080/13651820600804203]
- 34 Machado NO, Al Qadhi H, Al Wahibi K. Intraductal Papillary Mucinous Neoplasm of Pancreas. *N Am J Med Sci* 2015; **7**: 160-175 [PMID: 26110127 DOI: 10.4103/1947-2714.157477]
- 35 Hruban RH, Takaori K, Klimstra DS, Adsay NV, Albores-Saavedra J, Biankin AV, Biankin SA, Compton C, Fukushima N, Furukawa T, Goggins M, Kato Y, Klöppel G, Longnecker DS, Lüttges J, Maitra A, Offerhaus GJ, Shimizu M, Yonezawa S. An illustrated consensus on the classification of pancreatic intraepithelial neoplasia and intraductal papillary mucinous neoplasms. *Am J Surg Pathol* 2004; **28**: 977-987 [PMID: 15252303 DOI: 10.1097/01.pas.0000126675.59108.80]
- 36 Khan SA, Emadossady S, Ladep NG, Thomas HC, Elliott P, Taylor-Robinson SD, Toledano MB. Rising trends in cholangiocarcinoma: is the ICD classification system misleading us? *J Hepatol* 2012; **56**: 848-854 [PMID: 22173164 DOI: 10.1016/j.jhep.2011.11.015]
- 37 Utada M, Ohno Y, Tamaki T, Sobue T, Endo G. Long-term trends in incidence and mortality of intrahepatic and extrahepatic bile duct cancer in Japan. *J Epidemiol* 2014; **24**: 193-199 [PMID: 24614916 DOI: 10.2188/jea.je20130122]
- 38 Katanoda K, Ajiki W, Matsuda T, Nishino Y, Shibata A, Fujita M, Tsukuma H, Ioka A, Soda M, Sobue T. Trend analysis of cancer incidence in Japan using data from selected population-based cancer registries. *Cancer Sci* 2012; **103**: 360-368 [PMID: 22066698 DOI: 10.1111/j.1349-7006.2011.02145.x]
- 39 Bjerregaard JK, Mortensen MB, Pfeiffer P; Academy of Geriatric Cancer Research (AgeCare). Trends in cancer of the liver, gall bladder, bile duct, and pancreas in elderly in Denmark, 1980-2012. *Acta Oncol* 2016; **55**: 40-45 [PMID: 26767397 DOI: 10.3109/0284186X.2015.1114675]
- 40 Ewertz M, Christensen K, Engholm G, Kejs AM, Lund L, Matzen LE, Pfeiffer P, Storm HH, Herrstedt J; Academy of Geriatric Cancer Research (AgeCare). Trends in cancer in the elderly population in Denmark, 1980-2012. *Acta Oncol* 2016; **55**: 1-6 [PMID: 26781233 DOI: 10.3109/0284186X.2015.1114678]
- 41 Shin CM, Han K, Lee DH, Choi YJ, Kim N, Park YS, Yoon H. Association Among Obesity, Metabolic Health, and the Risk for Colorectal Cancer in the General Population in Korea Using the National Health Insurance Service-National Sample Cohort. *Dis Colon Rectum* 2017; **60**: 1192-1200 [PMID: 28991084 DOI: 10.1097/DCR.0000000000000876]
- 42 Seo HJ, Oh IH, Yoon SJ. A comparison of the cancer incidence rates between the national cancer registry and insurance claims data in Korea. *Asian Pac J Cancer Prev* 2012; **13**: 6163-6168 [PMID: 23464424 DOI: 10.7314/apjcp.2012.13.12.6163]
- 43 Chen MJ, Tsan YT, Liou JM, Lee YC, Wu MS, Chiu HM, Wang HP, Chen PC. Statins and the risk of pancreatic cancer in Type 2 diabetic patients--A population-based cohort study. *Int J Cancer* 2016; **138**: 594-603 [PMID: 26296262 DOI: 10.1002/ijc.29813]



Published By Baishideng Publishing Group Inc
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
Telephone: +1-925-2238242
E-mail: bpgoffice@wjgnet.com
Help Desk: <http://www.f6publishing.com/helpdesk>
<http://www.wjgnet.com>

