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REVIEW

The Danish National Penile Cancer Quality database

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Aim of database: The Danish National Penile Cancer Quality database (DaPeCa-data) aims to improve the quality of cancer care and monitor the diagnosis, staging, and treatment of all incident penile cancer cases in Denmark. The aim is to assure referral practice, guideline adherence, and treatment and development of the database in order to enhance research opportunities and increase knowledge and survival outcomes of penile cancer.

Study population: The DaPeCa-data registers all patients with newly diagnosed invasive squamous cell carcinoma of the penis in Denmark since June 2011.

Main variables: Data are systematically registered at the time of diagnosis by a combination of automated data-linkage to the central registries as well as online registration by treating clinicians. The main variables registered relate to disease prognosis and treatment morbidity and include the presence of risk factors (phimosis, lichen sclerosus, and human papillomavirus), date of diagnosis, date of treatment decision, date of beginning of treatment, type of treatment, treating hospital, type and time of complications, date of recurrence, date of death, and cause of death.

Descriptive data: Registration of these variables correlated to the unique Danish ten-digit civil registration number enables characterization of the cohort, individual patients, and patient groups with respect to age; 1-, 3-, and 5-year disease-specific and overall survival; recurrence patterns; and morbidity profile related to treatment modality. As of August 2015, more than 200 patients are registered with ~65 new entries per year.

Conclusion: The DaPeCa-data has potential to provide meaningful, timely, and clinically relevant quality data for quality maintenance, development, and research purposes.

Keywords: penile cancer, squamous cell carcinoma of the penis, clinical quality, national database, epidemiology, treatment

Introduction

Penile cancer is rare, and in Denmark, it has traditionally been diversely managed in dermatology, surgery, urology, and oncology without management guidelines and systematic quality monitoring. In 2009, a centralization of service to two university hospitals and two specialties, urology and oncology, favored continuous prospective data collection and initiated several quality improvements. The purpose of this study is to describe the Danish National Penile Cancer Quality database (DaPeCa-data).

Aim of database

The DaPeCa-data is a nationwide clinical cancer database with prospective data collection since June 2011 (Table 1). By the means of the Danish Civil Registration System,

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Table 1 Overview of DaPeCa-data

General information		Comments
Patient population	Incident penile cancer (penile squamous cell carcinoma)	Data collection since June 2011
Data coverage	Nationwide (centralized care since 2009 to two centers)	Two urological, two oncological, and two pathological sites participating in data registration
Data collection	Prospective	Data linkage from central registry combined with online prospective data collection of key clinical variables by treating clinicians
Clinical quality indicators	N=14	
Clinical data registration forms	Diagnosis clinical data registration form	
	Treatment clinical data registration form	
	Recurrence form	
	Follow-up form	
PROM questionnaires	Pilot study since January 2013	
	At time of diagnosis	
	1-year follow-up	
	2-year follow-up	
	3-year follow-up	
Treatments variables	Surgery	Primary penile surgery
		Lymph node surgery
	Radiation therapy	Inguinal
		Iliacal
	Combined chemoradiotherapy	Yes/no
Pathology variables	Biopsy definition	SNOMED codes P30610 biopsy, P30611 excisional biopsy, P30613 punch biopsy, P3061A incisional biopsy, or P30620 resection combined with SNOMED code T02530 skin on penis, T02540 skin on prepuce, T76330 prepuce, T7600 penis, or T76210 corpus cavernosum penis
	Penectomy definition	SNOMED codes P306X0 ectomy, or P306X4 tumorectomy combined with SNOMED codes T02530 skin on penis, T02540 skin on prepuce, T76330 prepuce, T7600 penis, or T76210 corpus cavernosum penis
	Lymphadenectomy definition and sentinel node biopsy definition	SNOMED code T08811 lymph node in the right inguinal region, T08812 lymph node in the left inguinal region, T0881B sentinel lymph node in the right inguinal region, or T0881C sentinel lymph node in the left inguinal region, squamous cell metastasis M80706, no extranodal extension M094B0, extranodal extension M094B1
	Grade of differentiation	High grade of differentiation (SNOMED code ÆYYD1), moderate differentiation (SNOMED code ÆYYD2), or low grade of differentiation (SNOMED code ÆYYD3)
	TNM stage	pTis (SNOMED code ÆF1810), pTa (SNOMED code ÆF181A), pTx (SNOMED code ÆF1870), pT1a (SNOMED code ÆF1831), pT1b (SNOMED code ÆF1832), pT2 (SNOMED code ÆF1840), pT3 (SNOMED code ÆF1850), and pT4 (SNOMED code ÆF1860)
	Surgical margin	Negative margin (SNOMED code M09400) and positive margin (SNOMED code M09401)
	Histological type	Squamous cell carcinoma (SNOMED code M80703)
	Histological subtype	Classical (SNOMED code M80703), verrucous carcinoma (SNOMED code M80513), basaloid (SNOMED code M81233), sarcomatoid (SNOMED code M80333), and adenosquamous (SNOMED code M85603)
Administrative variables	Region	
	Hospital site	
	Others	

Note: TNM cancer stage classification according to UICC.
Abbreviations: DaPeCa-data, Danish National Penile Cancer Quality database; PROM, patient-reported outcome measure; TNM, tumor lymph node and metastasis; UICC, Union for International Cancer Control; SNOMED, Systematized Nomenclature of Human Medicine.

the database enables individual data collection and holds potential for a large number of data-linkage opportunities to existing and longstanding national registries on, for example, socioeconomic and pharmacological parameters. To our knowledge, within penile cancer registries, this possibility is only matched by the Swedish penile cancer registry enabling DaPeCa-data to supply important population-based data on this rare entity. DaPeCa-data is affiliated with the Danish

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National Penile Cancer Quality group (DaPeCa-group), which consists of clinical and paraclinical experts from the specialties oncology, pathology, and urology. The group is responsible for developing national clinical guidelines for the staging, treatment, and follow-up of penile cancer in Denmark and decides on quality indicators and indicator standards based on experience and available literature.[1]

The overall aim of DaPeCa database and DaPeCa-group is to improve the quality of cancer care for penile cancer patients in Denmark. More specifically, the purpose of DaPeCa-data is to systematically collect key clinical variables on all incident penile cancer patients in Denmark for quality improvement and research.

The DaPeCa-data monitors clinical management of penile cancer. Penile cancer care in Denmark is centralized to two university centers.[2] The DaPeCa-data monitors referral practice from regional hospitals and private practices within surgery/urology, dermatology, and general practice and monitors guideline adherence at the treating centers. The DaPeCa-data aims to assure modern staging and treatment of patients with penile cancer and to provide data for development of the research field.

Study population

Penile cancer is a rare disease with an incidence in developed countries in the range of 0.5–2.5/100,000 population/year.[3] The incidence in Denmark is estimated to be 0.8/100,000 population/year, and the mean age at diagnosis is 65 years.[4] Data on ~65 patients are entered into the database each year, which has currently accumulated to more than 200 entries. Due to the rarity of the disease, it is a high priority of the DaPeCa-group and DaPeCa-data to collaborate with other databases in Scandinavia and in other Northern European countries with comparable populations. Currently, an application for a common Scandinavian database is under preparation with the success of the common Scandinavian childhood cancer databases as a model.[5]

Inclusion criteria and exclusion criteria

The DaPeCa-data registers all patients with newly diagnosed invasive squamous cell carcinoma of the penis in Denmark.

Patients with penile tumors with nonsquamous cell carcinoma histopathological features, such as sarcoma, melanoma, lymphoma, and metastases, from other cancers are not registered in the DaPeCa-data since each of these entities are covered by other national databases. Tumors of the distal urethra (navicular fossa) are registered if they involve external aspects of penile anatomy. Other primary urethral tumors are not registered.

Inclusion in the database is based on registration of a patient in the Danish Pathology Registry[6] with relevant Systematized Nomenclature of Human Medicine (SNOMED) codes or registration in the Danish National Patient Registry and the Danish Cancer Registry with relevant ICD codes (DC609, DC609J, DC609K, DC609L, DC609M, DC609N, DC609P, DC609Q, DC609R, DC609S, DC609T, DC609U, and DC609Z).[7]

Main variables and data quality

The variables currently collected via the online registration interface are listed in Table 2. Online registration by

Table 2 Overview of DaPeCa-data variables

Diagnosis	
Date of biopsy	Day/month/year
Has the patient been in contact with a highly specialized center?	Yes/no
Symptoms	None
	Bleeding
	Infection
	Lymph node enlargement
	Wound/tumor on penis
	Metastatic symptoms
	Others
Risk factors	None
	Phimosis
	Balanoposthitis
	Genital warts
	Previous circumcision
	Lichen sclerosus
	Others
Primary diagnosis based on	Clinical examination alone
	Histology
	Others
Primary tumor localization	Glans
	Prepuce
	Penile shaft
	Urethra
Imaging	CT
	MRI
	US
	Lymphoscintigraphy
	PET-CT
	None
Clinical TNM	T
	N
	M
Treatment	
Date of treatment decision	Day/month/year
Primary treatment	Laser
	Local excision
	Glans amputation
	Glans amputation with skin graft
	Partial penectomy
	Total penectomy

(*Continued*)

Table 2 (*Continued*)

Treatment	
Lymph node surgery	Yes/no
	Bilateral sentinel node/sentinel node left/sentinel node right
	Lymphadenectomy inguinal
	Lymphadenectomy iliacal
External beam radiation therapy (EBRT)	Curative intent/palliation
Chemotherapy	Yes/no
Combined chemoradiotherapy	Yes/no
Early complications demanding intervention (<3 months)	Reoperation
	Bleeding
	Wound infection
	Skin necrosis
	Meatal stenosis
	Lymphocele
	Thrombosis
	Lymphedema
	Erectile dysfunction
	Others
	No data
	None
HPV test on primary tumor	Negative/positive
Virus fag type	[.]
Cause of death	Penile cancer
	Others

Note: [.] Indicates that the virus fag type is entered in free text by the clinician via the database interface.

Abbreviations: CT, computed tomography; DaPeCa-data, Danish National Penile Cancer Quality database; HPV, human papillomavirus; MRI, magnetic resonance imaging; PET-CT, positron emission tomography/computed tomography; TNM, tumor lymph node and metastasis; US, ultrasound.

the urologist responsible for treatment has the advantage of a high level of data quality and variable validity. On the other hand, the registration interface is extensive and difficult to handle in daily practice. Ongoing validation projects of data accumulating via the Danish pathology and Danish patient registries aim to move a considerable part of the data registration toward automated data extraction and validation from these registries by treating clinicians via patient interview and examination or medical record verification. The annual reports published so far have been based mainly on this type of data, and it has turned out that continuous validation and interaction between clinicians and statisticians are of great importance in order to produce a valid and meaningful report. A solid framework for continuous validation algorithms and iterative data checking has to be designed and validated to speed this process up in order to meet the demand of the political visions of close-to real-time quality data production. This process is currently in an early phase, and limited resources are a main challenge.

Follow-up

DaPeCa-data has promising potential to virtually complete the follow-up of its patient population. All penile cancer patients included in DaPeCa-data can be followed until death or emigration by means of data linkage to the Danish Civil Registration System.

An ongoing effort aims to facilitate automated follow-up prompts to appear at the relevant administrator in order to enter the follow-up data continuously. If this system fails to be implemented, the database will be updated in relation to specific studies with retrieval and addition of relevant data from records and registers via Danish Civil Registration System.

Examples of research

The group behind the DaPeCa-data is active within the research field and publishes regularly on the topic;[2,8–12] however, no research paper as of yet has used data registered in the DaPeCa-data due to the rarity of the disease and the fact that the database was only established in June 2011. The first validation study is under preparation. Since its inception in 2011, DaPeCa-data has annually released a report with analyses of the clinical quality indicators (Table 3). However, results and data presented in the annual reports from the initial development years should be interpreted with reservation and caution. As reflected by the most recent annual reports, data validity and completeness has been improving over time, but validation and algorithm optimization is only progressing slowly at the current level of support and funding.

Administrative issues and funding

The DaPeCa-data is administered in the two centers, such as Copenhagen University Hospital and Aarhus University Hospital, responsible for staging and treatment of the patients. Validation lists of all patients with the diagnosis within the uptake area of the specific center are presented to the database administrators every 3 months. Data are entered into an Internet-based online user interface with integrated range validation by treating clinicians. The completeness of registration is high, in some years approaching 100%. Data are linked to each patient's unique ten-digit civil personal registration number. The database steering committee consists of clinicians and academic experts representing urology, oncology, and pathology and continuously updates and specifies the quality indicators and the contents of the data profile ensuring a clinically meaningful and realistic dataset. The database receives a limited amount of funding from

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Table 3 Overview of DaPeCa-data quality indicators

ID	Name	Format (indicator standard)	Type	2013–2014
DaPeCa-indi-1	Referral pattern: fraction of patients with the diagnosis in contact with a highly specialized center	>75%	Process	93%
DaPeCa-indi-2	Sentinel node guideline adherence: fraction of relevant patients (cN0/cNx) undergoing sentinel node biopsy at diagnosis	>90%	Process	96%
DaPeCa-indi-3	Recurrence pattern: fraction of patients experiencing recurrence within five years of primary treatment	<50%	Result	No data
DaPeCa-indi-4	Blood transfusion: fraction of patients in need of pre- or postoperative blood transfusion	<10%	Process	0
DaPeCa-indi-5	30-day mortality: death within 30 days after primary treatment	<0.5%	Result	0
DaPeCa-indi-6	Pathology registration: fraction of patients with registration and coding of a complete set of key histopathology parameters	Under implementation	Process	No data
DaPeCa-indi-7	1- and 5-year overall survival after invasive penile cancer diagnosis, per center, and overall	Under implementation	Result	No data
DaPeCa-indi-8	1- and 5-year cancer-specific mortality after invasive penile cancer diagnosis, per center, and overall	Under implementation	Result	No data
DaPeCa-indi-9	1- and 5-year overall survival after inguinal lymph node dissection for lymph node-positive penile cancer, per center, and overall	Under implementation	Result	No data
DaPeCa-indi-10	1- and 5-year cancer-specific mortality after inguinal lymph node dissection for lymph node-positive penile cancer, per center, and overall	Under implementation	Result	No data
DaPeCa-indi-11	Time from diagnosis to inguinal lymph node dissection for lymph node-positive penile cancer, per center, and overall	Under implementation	Process	No data
DaPeCa-indi-12	Total number of in hospital days within 90 days after inguinal lymph node dissection for lymph node-positive penile cancer, per center, and overall	Under implementation	Result	No data
DaPeCa-indi-13	1- and 5-year overall survival after oncological treatment with curative intent for lymph node-positive penile cancer, per center, and overall	Under implementation	Result	No data
DaPeCa-indi-14	1- and 5-year cancer-specific mortality after oncological treatment with curative intent for lymph node-positive penile cancer, per center, and overall	Under implementation	Result	No data

Notes: cN0, clinically lymph node negative; cNx, clinical lymph node status not assessed/not reported.
Abbreviation: DaPeCa-data, Danish National Penile Cancer Quality database; ID, identification.

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public sources via the Danish Regions and is independent from private funding. DaPeCa-data is under the auspices of the Danish Multidisciplinary Cancer Groups (DMCG.dk), which is an umbrella organization comprising 24 national cancer groups and clinical databases in Denmark. The urological cancer groups and databases are further organized under the subgroup for Danish Urological Cancer Groups. The DaPeCa-data receives a limited administrative support from the Danish Clinical Quality Improvement Program (RKKP).[13] Technical support and data management service are provided by the Competence Centre for Health Quality and Informatics (KCKS-Vest),[14] and epidemiological and statistical support to the annual reports is provided by the Competence Centre for Clinical Epidemiology and Biostatistics, North (KCEB-Nord).[15] Patient-reported outcome measure data are collected nationwide at both urological treatment centers as a part of an ongoing quality of life and sexuality study. On the basis of this pilot project, which is based on an adapted and validated version of the Scandinavian Prostate Cancer Group 4 items, a patient-reported outcome measure data collection is planned to commence with a validated set of sexuality and quality of life questionnaire items.

DaPeCa-data collects nationwide health care data in accordance with Danish data protection laws. Laws and procedures for data access to DaPeCa-data are governed by the Data Protection Agency (Datatilsynet) and the Danish Ministry of Health (Sundhedstyrelsen). Applications for data access to DaPeCa-data are reviewed by the Chair and Steering Committee upon application to RKKP.[13]

Conclusion

DaPeCa-data has been in existence since 2011. More than 200 patients are registered. Validation of the register data sources is ongoing, and the first validation study based on data from the DaPeCa-data is under preparation. With an increased level of support and funding, the important validation iterations could be optimized faster. The DaPeCa-group has already published studies based on medical

records. Updated information on DaPeCa-data is available at the DaPeCa-group Internet homepage: http://ducg.dk/dapeca-peniscancer/.

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Disclosure

The authors report no conflicts of interest in this work.

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