Artificial intelligence, big data, clinical decision support, and knowledge design

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Kurzweil, R. The singularity is near. Viking, 2005.

Clinical decision support in practice – HL7 standards, interoperability, and selected applications,
Vienna, 23 May 2017
Digitalization in clinical medicine

- Stage I: Digitizing medical patient data
  - EHRs, EMRs, Health Apps, images, bio-signals, national, ...

- Stage II: Digitizing clinical workflows
  - In-patient care, wards, departments, out-patient, home, chronic care, ...

- Stage III: Digitizing medical knowledge
  - Anatomy, physiology, pathophysiology, nosology, pharmacology, pharmacogenomics, ...

Clinical decision support—Applying knowledge to data

- Better care
- Patient safety
- Quality assurance
- Cost reduction

Clinical demand

Quality assurance

Better care

Cost reduction

Patient safety
Approaches to CDS

- abstracted published texts
  - physician-authored texts
    - display
      - authoritarian
        - UpToDate by Wolters Kluwer
    - CDS
- “big” raw data
  - data mining
    - induction
      - empirical, low level
        - Watson Health by IBM
    - CDS
- “big” published texts
  - text mining
    - induction
      - empirical, high level
    - CDS
- knowledge design
  - deduction
    - axiomatic
    - Knowledge Engines by Medexter
  - knowledge-based systems
    - CDS
Hepatitis B and pregnancy

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Deputy Editor: Jennifer Mitty, MD, MPH

Contributor Disclosures

All topics are updated as new evidence becomes available and our peer review process is complete.

Literature review current through: Feb 2017 | This topic last updated: Feb 04, 2017.

INTRODUCTION — Hepatitis B virus (HBV) infection during pregnancy presents with unique management issues for both the mother and the fetus. These include the effects of HBV on maternal and fetal health, the effects of pregnancy on the course of HBV infection, treatment of HBV during pregnancy, and prevention of mother-to-child transmission.

Prevention of mother-to-child transmission is an important component of global efforts to reduce the burden of chronic HBV since vertical transmission is responsible for approximately one-half of chronic infections worldwide. The risk of developing chronic HBV infection is inversely proportional to the age at time of exposure. The risk is as high as 96 percent in those exposed at birth without vaccination, while the risk is much lower (about 20 to 30 percent) in those exposed during childhood. Maternal screening programs and universal vaccination of infants have significantly reduced transmission rates.

This topic will review special considerations for the management of patients with acute and chronic HBV infection during pregnancy and the post-partum period, as well as prevention of mother-to-child transmission. Additional topic reviews that address prevention and management of HBV infection in children, and liver disease in pregnancy, are found elsewhere.

- See “Hepatitis B virus immunization in infants, children, and adolescents”
- See “Hepatitis viruses and the newborn: Clinical manifestations and treatment”
- See “Overview of hepatitis B virus infection in children and adolescents”
- See “Acute fatty liver of pregnancy”
- See “HELLP syndrome”
- See “Intrahepatic cholestasis of pregnancy”
- See “Approach to liver disease occurring during pregnancy”
- See “Pregnancy in women with pre-existing chronic liver disease”

ACUTE HEPATITIS B VIRUS INFECTION — Acute viral hepatitis is the most common cause of jaundice in pregnancy [1]. Other causes include liver diseases associated with pregnancy, such as acute fatty liver of pregnancy, HELLP syndrome, and intrahepatic cholestasis of pregnancy. (See “Approach to liver disease occurring during pregnancy” and “Acute fatty liver of pregnancy” and “HELLP Syndrome” and “Intrahepatic cholestasis of pregnancy.”

Acute hepatitis B virus (HBV) infection during pregnancy is usually mild and not associated with increased mortality or teratogenicity [1,2]. Thus, infection during gestation should not prompt consideration of termination of the pregnancy. However, there have been reports of an increased incidence of low birth weight and prematurity in infants born to mothers with acute HBV infection [2,3].

Acute HBV occurring early in the pregnancy has been associated with a 10 percent perinatal transmission rate [3]. Transmission rates significantly increase if acute infection occurs at or near the time of delivery, with rates as high as 60 percent reported [1]. Thus, serial monitoring should be performed throughout pregnancy, and if the mother remains hepatitis B surface antigen (HBsAg)-positive.
Watson Health by IBM: “Big” raw data and “big” published texts
MONI by Medexter for HAI surveillance: Knowledge design
MONI: Healthcare-associated infection monitoring and surveillance at ICUs
Clinical event monitoring at ICUs: Knowledge design
Medical Knowledge CDS Engines

**Use it**
as part of your EMR
or
as stand-alone application

**The prediction:**
In the future, any clinical activity will be either supported or substituted by Medical Knowledge Engines.

**The medical knowledge**
- clinically proven knowledge: rules, tables, decision trees, guidelines, scores, algorithms, ...
- evidence-based, application-ready knowledge packages
- knowledge design or knowledge through machine learning

**The CDS engine**
- HL7’s Arden Syntax medical knowledge representation and processing, with fuzzy methodologies
- scalable from cloud-based services to mobile apps
Arden-Syntax-based CDS authoring tool and engine

Available for:
- Microsoft Windows
- X/Unix/FreeBSD/386/64
- Linux
- MacOS
- Amazon Cloud
- Docker

Third-party systems extensions
- Activiti

Medical software platforms
- ID Berlin
- Healcloud
- Epic
- Ishmed

Electronic health record integration

- RESTful communication
- SOAP communication
- Product integration

ArdenSuite Server
- ArdenSuite web service module
- ArdenSuite administration module
- Arden Syntax engine
- Curly-braces "{}" accesses
- Arden Syntax objects
- Data query
- Data results

ArdenSuite IDE
- ArdenSuite authoring tool
- Arden Syntax compiler
- Compiled MLMs
- AuthorMLMs
- Error messages
- Warnings

- Supported data resources
- Database
- FHIR resource
- Web services for EPIC

being examined:
- Camunda BPMN
- data platforms and warehouses
- CDS Hooks and clinical microservices